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FROM WOOL TO LAMBS.

(EDITOR.)

When the price of a nation's principal export product tumbles 20 per cent. it is a serious happening, but when that nation supplies 25 per cent. of the world's requirements of the commodity, and it represents 42 per cent. of the total exports of the nation, then the matter borders on the alarming. Yet that has happened in the case of Australia's wool-growing industry, if we compare the peak year of the past decade, 1924-25, with the 1927-8 season. The average values of wool, per lb., exported in the years first mentioned were for greasy 27.10d. and scoured 39.81d., while in 1927-8 they fell to 20.48d. and 31.87d. respectively. The estimated figures for the 1928-9 season offer neither consolation nor re-assurance, indication being that they will average still less when the year's operations are accounted. It is true that during the past decade we have participated in very substantial returns for our staple product, although these good prices do not constitute anything in the nature of a record. There have been some very handsome individual prices obtained in earlier times. The pioneer of Australian studmasters, Captain John McArthur, is said to have received 196d. per lb. for a single bale of his wool, and according to the Commonwealth Official Year Book there is a record of 136d. per lb. having been obtained as late as 1920. But such exceptional prices as these have no true bearing on the national value of the industry. In later years the highest price given for Australian greasy wool is stated as 53¼d. per lb., and it seems that present buyers are only prepared to offer a lamentably reduced figure.

It would be idle speculation to attempt a forecast of what the near future holds for the wool grower, but undue pessimism is quite unwarranted. It has been contended that the high prices ruling during abnormal years

have driven manufacturers to seek refuge in substitutes, and that pure wool will not again return to its former popularity. However, it may be accepted as a general rule that the fashion burgeons from the world's parity value of any commodity, and wool is too useful a produce to be easily displaced from the looms, provided it can be produced at a reasonable cost. From the farmer's viewpoint it will be found no more than sane economy to regulate his production in such a way as will best tend to stabilise the market and bring a fair return for his labour. It is an unwise and unnecessary risk to carry all your eggs in one basket, is a proverb that retains its applicability.

Let it be faced that there is at present a serious and substantial decline in the price of wool, and to the farmer producing it in conjunction with other goods, this decline is likely to make an appreciable difference to his sources of income. It behoves him, therefore, to give some thought to methods of improving his position. Fortunately he is more favourably situated than the pastoralist, because in many instances he can convert from wool to lambs without very serious inconvenience. It will involve a change that calls for no drastic measures, and with a recovery of the wool market the change over will have brought about no complications entailing a struggle to get back to the former lines of breeding. Many farmers are already serious in their consideration of this point, and it is almost certain that within a comparatively short space of time there will be a notable transformation from wool production to fat lambs.

Quite apart from the aspect of wool values, which are liable to fluctuation, it is inevitable that we must seek to build up an export lamb trade, for our flocks already exceed nine millions in this State alone, and their progeny must become far in excess of the demand for local consumption. Those who, from necessity or choice, enter upon the business of raising lambs for market will, if they are wise, aim at producing lambs that will best comply with the import market requirements and consequently bring in the best returns. To help towards this end it was opportune that the authorities at the Department of Agriculture decided upon a conference for the discussion of a policy for adoption. Mr. E. H. B. Lefroy, of Cranmore Park, Walebing, was invited to join the discussion, and with the Director of Agriculture (Mr. G. L. Sutton), the Sheep and Wool Inspector (Mr. Hugh McCallum), and the Superintendent of Wheat Farms (Mr. I. Thomas) held a meeting on the 13th November. As a result of their deliberations the following conclusions were reached as a basis on which advice would be tendered to farmers on the matter of raising lambs for market:—

(1) That the most suitable fat lamb would be produced as the result of mating a Southdown, Shropshire or Dorset Horn ram with a crossbred ewe.

(2) That the most suitable crossbred ewe for the purpose would be produced as the result of mating good type merino ewes with a Border Leicester, English Leicester, or Lincoln ram, or where foot-rot is troublesome, with a Romney Marsh.

These latter conclusions, based on South Australian and New South Wales experiments, have been accepted as sufficiently definite without further trial. It is, however, considered advisable to conduct experiments with the Southdown, Shropshire and Dorset Horn rams mated with the Border Leicester-Merino ewes, in order to establish their relative suitability under local conditions, and it was decided to carry out these experiments on the Avondale farm.

Having regard also to the desirability of building up a simple sheep husbandry on the farm, it was further decided to recommend the farmer to confine his attention to one phase of sheep-breeding only, and thus avoid the necessity for keeping more than one breed of ram.

Dividing this branch of agriculture into two principal features, it was agreed that—

(a) For the production of wool the farmer thus engaged should keep merino rams only, and mate with merino ewes.

(b) For the production of crossbred mothers for fat lamb raising he should use long-wooled British rams only, and of the following breeds: Border Leicester, English Leicester, Lincoln (or Romney Marsh) rams, and mate them with good merino ewes.

(c) For the production of fat lambs for export or local market short-wooled British rams only should be used, and only rams belonging to one of the following breeds should be kept:—Southdown, Shropshire, or Dorset Horn.

Departmental policy favours a consultative committee to deal with the projects under investigation, and Mr. Lefroy was asked, and has consented, to act in conjunction with the remaining personnel of the conference, and the result of their experiment and experience will be watched with interest.

As merino ewes are necessarily the basis upon which the export lamb industry will be built up, it is opportune to again remind farmers, whose function it will be to raise these ewes, of the departmental policy for the care and improvement of merino flocks, which has been consistently advocated by the Sheep and Wool Inspector and advisers on the staff of the Department of Agriculture. The important point to remember is that the improvements will be brought about in the first place by the use of pure bred rams of the type and strain most nearly approaching the ideal the farmer has in mind, and the continued use of the same type and strain from established pure studs to achieve and maintain the purity of the type. There must be a constant and systematic culling of inferior and aged animals, and proper care of the flock throughout the year, which involves ample provision of fresh, clear water, the supplementation of pastures where this is necessary, and strict attention to keeping the animals free from parasites.

There has been practically no export of lamb from this State since 1924, with the exception of some consignments totalling 6,685 carcases dur-

ing the 1927-8 season. This has been due in a great measure to the buoyancy of the wool market as well as the local consumption of the food. The Australian likes his mutton, and in comparison with the people of other countries he eats it with avidity. It has been calculated that the consumption of lamb and mutton in Australia is to population approximately 61 lbs. per head per annum, as against 27 lbs. in the United Kingdom, 6 lbs. in Canada, and 5½ lbs. in the United States of America. It must be borne in mind, however, that in other countries the people are not so favoured with opportunities of obtaining this article of diet, and there is, generally speaking, a good market for fat lambs.

Despite the Australian's addiction to this delicacy, the rapid increase of our flocks, our huge areas of pastoral country, our wonderful climate and the paucity of our population makes an export trade a necessity. The demand for lambs in the great Smithfield markets evidences a marked preference for New Zealand Canterbury lambs as against other importations. Latest quotations are given as 8¾d. per lb. light (28 to 36 lbs.), with their nearest rival, Victorian lambs of the same class, quoted ½d. per lb. lower. The demand for Canterbury lambs, however, is not the creation of a season, and the enviable reputation of the New Zealand grower has to be "gone after," and will take some pursuit. Such preferences are only achieved by begetting a confidence in the goods delivered, and that confidence can only be inspired through experience of past excellence and a knowledge of the bona fides of the grower. Breeding of lambs is not, therefore, the beginning and the end of the business, and handling and dressing are important phases in the delivery of a good carcase. "Tender as a lamb" is not an imaginative expression, but based on actual fact. In discussing this with a prominent authority connected with one of the largest firms operating in Australasia the writer was astonished at instances given where careless handling blemished and spoiled until a first-class lamb was reduced to a reject. An over zealous sheep dog or the intervention of a too-hasty trucker can literally cut shillings out of the consignor's lamb, and if applied to his consignment may easily cause a big subtraction from the anticipated cheque. But these considerations may be left for the time being. Breeding of the right class of lamb is the first step in the direction to be travelled, and the advice and experiment of those who have undertaken investigation for the farmers' benefit should be closely followed.

THE FERTILISERS ACT, 1928.

N. Davenport, B.Sc. (Agric.),
Inspector of Fertilisers.

Owing to the increased sale of Fertilisers in this State, the improved methods of manufacture, and a more varied and exacting demand by our agriculturists, it was evident that the Fertilisers and Feeding Stuffs Act of 1904 had become inadequate for its purpose.

When revising this Act, in order to meet present demands, it was decided to separate the two phases, and the result of this division was that separate Acts, dealing with Fertilisers and Feeding Stuffs respectively, were placed before Parliament. The former was assented to on 15th November, 1928. It contained provision for its proclamation upon a day to be fixed, which was decided upon as 1st November of this year, this being the commencement of the official fertiliser year.

In this Act particular attention has been given to the definition of terms, many of which did not occur in the previous Act, while those which are common to both have, in most cases, been treated more explicitly.

The additional definitions include the following:—

"Bone dust" or "Bone meal." This must consist solely of disintegrated bones, as no admixture of any nature is permitted.

"Bone Fertiliser" or "Bone Manure." This provides for the manufacture of mixed manures of a total or partial organic nature, in which the phosphoric acid may be supplied only from bones and superphosphate.

"Fine material." Various grades of Fine Material are specified for different manures. This is a general term, meaning particles smaller than the prescribed size in each particular case.

"Grade Formula" provides for a concise description where it is desired to emphasise the percentage contents of the fertilising ingredients in a fertiliser (provision being made for nitrogen, phosphoric acid, and potash), or where, especially in the case of mixed manures, the composite name representing the mixture would be too cumbersome. The order in which the fertilising ingredients may be represented by integral figures denoting the percentage is nitrogen, phosphoric acid, potash. Thus, a fertiliser, numbered 3:15:6 would mean that it contained 3 per cent. of nitrogen, 15 per cent. of total phosphoric acid, and 6 per cent. of potash.

"Gypsum" has been defined owing to the wider use of this fertiliser and because of specific reference to it in the present Act.

"Lime" has also been defined, as it was found necessary to differentiate between "caustic lime" and "agricultural lime," the latter being in the form of slaked lime or of the carbonate in either the natural or artificial form.

"Phosphate Fertiliser" is the term provided for the description of fertilisers which contain Phosphoric Acid, but do not conform to the standards for bone dust, bone meal, bone fertiliser, or bone manure.

"To buy" and "to sell" are also treated exhaustively for the purposes of the Act.

The various combinations of phosphoric acid with respect to its solubility are described as those which are determined by particular processes of analysis.

"Fertiliser" is defined in a more particular manner with respect to special fertilising ingredients making certain exceptions and providing for the proclamation of material which is not considered as a fertiliser for the purposes of the Act.

As this Act has been introduced with the main object of protecting the consumer, it is provided that it is not applicable to the sale of bulk lots of fertilising compounds to a fertilising manufacturer, or to the sale of quantities less than one hundredweight. In the latter case, however, it is necessary that the fertiliser shall be registered, and that each package shall be conspicuously marked with a copy of the registered brand and the name of the fertiliser.

Application for registration must be made prior to 1st November of each year, as on that date all previous registrations are cancelled. The information required for registration has been increased, one of the objects being the computation of unit values for the different fertilising ingredients.

The publication of a list of dealers, registered fertilisers, and particulars of registration may be made in the *Government Gazette* or this *Journal of Agriculture,* as soon after the commencement of each fertiliser year as is possible, *i.e.,* as soon as registrations are complete for the moment.

In order to ensure that the material demanded and paid for is supplied, it is incumbent upon the seller to issue an invoice with each sale, provided that the quantity sold is one hundredweight or more. On this invoice shall be stated the name and business address of the seller and of the manufacturer, if the fertiliser is manufactured within the State; a copy of the registered brand and name of the fertiliser; the minimum percentages of the fertilising ingredients and the forms in which they occur in the fertiliser, and other particulars such as fineness, percentage of calcium as calcium oxide, and gypsum when these are applicable.

Owing to the difficult nature of keeping the fertilising ingredients of a manure exactly to the registered percentages, limits of variation are set for the respective constituents. These are:—

For nitrogen	.5	per cent.
„ total phosphoric acid P_2O_5	1.5	„
„ water soluble phosphoric acid P_2O_5	.5	„
„ citrate soluble phosphoric acid P_2O_5	.5	„
„ acid soluble phosphoric acid P_2O_5	.5	„
„ potash K_2O	.5	„
„ lime	7.0	„
„ fine material	5.0	„

This means that if deficiencies occur greater than those in the above table, then the seller is liable to prosecution.

In the case of fertilisers containing phosphoric acid, however, an excess of water or citrate soluble phosphoric acid may be offset against a deficiency of acid soluble phosphoric acid, also an excess of one of the water soluble or citrate soluble forms may be offset against a deficiency of the other.

In the case of bone dust and bone meal also, natural variations make it difficult to keep to a definite standard for both nitrogen and phosphoric acid, and provision is made here also for the offsetting in proportion of an excess of one ingredient with the other, or *vice versa.*

Provision is made for the prevention of admixture of mineral substances such as superphosphate and gypsum with bone fertiliser or bone manure

advertised as such and also of the suggestion of bone manure in material which is being sold as phosphate fertiliser, which according to the definition contains no bone manure.

Inspectors will be appointed and analysts will be licensed by the Governor in order to administer the Act.

For the purpose of taking samples of fertilisers inspectors may enter any place where these are, or may reasonably be supposed to be, kept for sale or sold. Samples may also be taken of any fertilisers in transit.

The sample taken is divided into three. One is given to the seller or his agent, one is given to an analyst for analysis, and the remaining sample is kept as a referee, to be analysed if a dispute occurs.

The result of analysis is sent to the vendor or his agent and may be published in the *Gazette* or any newspaper and in such other manner as is prescribed.

Provision has been made in the Act for the prescribing of particulars under many of the sections, to which effect was given by the publishing of a set of regulations in the *Government Gazette* of 25th October, 1929.

Under Section 12 of the Act certain manures are prescibed to which degrees of fineness are applicable.

These have been given in the regulations and are as follow:—

(a) Bone dust, bone meal, bone fertiliser, bone manure and blood and bone, at least 95 per cent. of which will pass a sieve with circular holes 3/16in. diameter, and at least 65 per cent. pass a sieve of 20 meshes per linear inch.

(b) Basic slag and Thomas' phosphate, at least 95 per cent. of which must pass a sieve of 30 meshes to the linear inch and at least 80 per cent. pass a sieve of 90 meshes to the linear inch.

(c) Ground limestone and lime sand shall be of such fineness that 80 per cent. will pass a sieve of 20 meshes to the linear inch.

In order to prevent the sale of fertilisers which are not of a reasonably high manurial standard, minimum limit of fertilising ingredients have been fixed for the following:—

Basic slag or Thomas' phosphate.
Bone dust or bone meal.
Blood and bone.
Superphosphate.
Ground limestone and lime sand.
Gypsum.

The regulations also stipulate the proportion of phosphoric acid in excess in bone dust, bone meal, and blood and bone, which may be offset against a deficiency of nitrogen or *vice versa*, and this paragraph reads as follows:—

> "Any deficiency of nitrogen may be considered as compensated for by an excess of phosphoric acid (P_2O_5) not less than four times the deficiency of nitrogen and any deficiency of phosphoric acid by an excess of nitrogen not less than one-fourth the deficiency of phosphoric acid."

A detailed method of sampling is included, together with the method of analysis for the different fertilising ingredients which come within the province of the Act.

The first schedule is composed of a set of forms for the following purposes:—

Application for registration of fertiliser.
Application for amendment of registration of fertiliser.
Invoice to be supplied on sale of fertiliser.
Certificate of Analysis.
Record of sample and its description received by the Analyst from an Inspector.
Notification of result of analysis to vendor.

The second schedule deals with the fees payable under the Act, and are as follow:—

Fees for Registration, etc.

	£	s.	d.
For 20 fertilisers or under	5	0	0
For every additional fertiliser	0	5	0
For the inspection of the register	0	2	6
For a certified copy of each entry	0	2	6
Amendment of percentage	0	2	6

Fees for Analysis.

	Scale A.	Scale B.
For the determination of any one constituent ..	15s.	5s.
For the complete analysis of a fertiliser having four or more fertilising constituents ..	60s.	20s.

Scale B shall apply only to *bona fide* graziers, farmers, or market gardeners.

Scale A shall apply to all other applicants for an analysis.

"THE JOURNAL OF AGRICULTURE"

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Editors of agricultural and country papers are invited to reproduce any of the articles contained in this *Journal*, providing the usual acknowledgment is made.

If you are not receiving the *Journal*, which is issued quarterly, and wish to do so, please forward your name and postal address to the Director of Agriculture, Perth.

HONEY.

H. WILLOUGHBY LANCE,
Apiculturist.

The last few years have made many changes in the eating habits of most people. Many patent foods have been introduced, and scientists have been stressing the value of carbohydrates, proteins, vitamins, etc. Other schools, particularly in America, have been teaching physical culture, combined with careful study of diet, as the surest way to health.

There is little doubt that primitive man, with his open air life—plenty of exercise and living on the products of the land—passed a more healthy existence than the town dweller of to-day. The value of fruit, vegetables, and honey—the original and simple forms of food provided for man—are gradually being realised. To many, however, fruit and honey are still considered as extras instead of staple articles of diet. Fresh fruit and vegetables can only be obtained at certain seasons of the year; but honey can be obtained all the year round, as it will keep good indefinitely, and should always be in the larder and on the table with the bread and the butter.

Honey, as we all know, was up to the sixteenth century practically the only food-sweet known; then sugar was introduced, and on account of its cheapness and the ease with which it could be handled, almost ousted honey from the diet of civilised man. Sugar, however, cannot take the place of honey in dietary value. It requires the aid of the juices of the stomach to digest it and to enable it to be assimilated by the body. Honey is the nectar of the flowers, already digested by the bees, and is easily assimilated without the aid of other substances or juices.

When the field bee has gathered her load of nectar, she carries it home to the hive in her honey sack. Here she passes it on to another and younger bee, who deposits it in the cells, where it is ripened. While these bees are carrying the nectar it is presumed that some chemicals are added to it, and that some of the water is evaporated, then after being placed in the cell further water is evaporated by the heat of the hive and ripened until it becomes honey as we know it.

The principal constituents of honey is of course sugar, but of a different character to cane sugar and belongs to the class of "inverted" sugars. When light is passed through "inverted" sugar, the light is deflected to the left instead of the right as with ordinary sugar. Inverting is part of the chemistry of digestion and takes energy from the body. Honey, being already inverted, is immediately absorbed by the system, and the energy, which would have been used, is saved for other purposes. Honey is a carbohydrate food and produces energy and vitality; and as a food for a man doing hard physical work cannot be beaten. It is, however, more than an energy food, as it contains small quantities of proteins by means of pollen grains which get into the honey during gathering and extracting, and these proteins assist in building up the tissues.

Mineral salts are also contained in honey, the principal being phosphorous and iron. The dark honeys usually contain more of these latter than the light. In many countries there is a prejudice in favour of light honey; this usually has a milder flavour, which some people prefer. It should, there-

fore, be remembered that dark honey is usually better for the system, and people should accustom themselves to the use of this.

I have recently had some of our local honeys analysed by the Government Analyst with the result shown below:—

	Taylorina.	Powder Bark Wandoo.	Tuart.	Dark Coastal.
	%	%	%	%
Water	17·28	17·42	18·83	17·36
Protein (N x 6·25)	0·23	0·13	0·31	0·36
Fat (wax)	·02	·04	·06	·06
Sugar	82·34	81·88	80·07	81·46
Ash	·13	·53	·73	·76
	100·00	100·00	100·00	100·00
The ash contained phosphorus	·004	·002	·006	·007
Equivalent to phosphoric anhydride	·009	·005	·015	·017
Iron	·0007	·0010	·0005	·0016

The Taylorina (*Psoralia pinnata*) is a very light honey obtained from a bush growing in the Albany district, originally imported from South Africa.

Powder Bark Wandoo is very similar to the ordinary White Gum Wandoo. Both of these are very light honeys.

Tuart is a large eucalypt growing along a strip of coast country from Busselton to about Wanneroo.

Coastal dark is obtained from a variety of trees and bushes and cannot be identified with any particular tree or bush. Both of these latter honeys are dark.

It will be noted that the lightest of our West Australian honeys is the richest in sugar but second lowest in both phosphorus and iron.

The Power Bark Wandoo, a slightly darker honey, comes second with 81.88 per cent sugar, lowest in phosphorus, but second highest in iron.

Tuart shows highest in water, lowest in sugar, and highest in phosphorus.

Coastal, which is a honey obtained along our coastal districts at certain seasons of the year, more particularly in the spring, is a natural blend from a variety of sources, and varies from time to time. It will be noted that this honey is richest in proteins, phosphorus and iron, with only a little more water than Taylorina. As regards water, it must be remembered that this will vary in different seasons and from time to time while the nectar is being gathered, depending upon the humidity of the atmosphere and the time taken by the bees to ripen the honey.

As regards colour, this is no real criterion of the value of honey, but the colour of many of our rich dark honeys is due to the presence of both tannin and iron and is an almost sure indication of the presence of iron. What is meant when one speaks of the colour of honey is that if a beam of pure white

light is passed through honey, some of its constituents will be absorbed by the honey while others will pass through. When we speak of honey as "amber" we mean that the combination of wave lengths of light which affect the human retina and have passed through the honey are such as to give the effect of what we term "amber," while the other colours in the original white light are absorbed. Now this absorption will depend upon the thickness of honey through which the light has to pass. Take two bottles of honey of the same colour and place them side by side, and the effect on the retina will be a certain colour, then place them one in front of the other and a much darker colour will be obtained.

This is an important point to be remembered by those bottling honey for sale, on account of the prejudice of the public in favour of light honey; honey bottled in tall, thin bottles will sell more readily than in short, fat bottles. The beekeeper selling honey has to remember the public prejudice, but at the same time he should point out the excellent food value of the darker honey owing to the presence of protein, phosphorus and iron, which are valuable body-building substances. He should also stress the value of honey as a carbohydrate food producing energy and vitality, and the ease with which it is assimiliated by the body compared with that of cane sugar.

NOTES ON FIRST REPORTED CASE OF LAMZIEKTE (PARABOTULINUS) IN CATTLE IN WESTERN AUSTRALIA.

(A. F. Flood, M.R.C.V.S., Dip. Agric.)

It may be of interest to readers to know that the first case of Lamziekte in Cattle in this State was diagnosed by the Veterinary Branch during February 1924, nearly six years ago. In response to an urgent letter and telegram from an Agricultural Society in the Eastern wheat belt reporting heavy losses in the district in 1923 and 1924 an investigation was made by the Veterinary Branch and the cause of the mortality was found to be due to Stiff Sickness, *i.e.*, Lamziekte. Owners were advised to burn all carcases of cattle and rabbits, etc., and to supply sterilised bonemeal to their cattle, especially to milking cows and heifers, either as a lick or mixed with the feed.

Since 1924 the disease has been reported from various centres, especially in the wheat belt and it is still responsible for considerable losses of stock. It is necessary at this time of the year to issue a warning to all stock-owners that carcases of rabbits, sheep or cattle left lying in paddocks are very dangerous to healthy stock, more especially during the Summer months. They should be burnt and ashes buried.

Cattle and sheep should be supplied with minerals deficient in pastures in the form of a lick. If licks are not available stock will not thrive, and may even die in a few days if infected by chewing infected bones in the paddocks.

THE UNSOUND ECONOMICS OF THE F.A.Q. STANDARD FOR SELLING AUSTRALIAN WHEAT.*

Geo. L. Sutton,
Director of Agriculture.

In presenting this paper it is intended to establish—

(1) That the use of the F.A.Q. Standard is based upon misconceptions;

(2) That its use involves immense enonomic loss;

(3) That with its continuance the economic loss is likely to increase, and consequently

(4) That an improvement in the Standard by which our main crop is sold is desirable and possible.

Commercial standards, for the purpose of trading in Australian wheat, were unnecessary in the early days of our agricultural history, when the market was a restricted and localised one. Under such circumstances wheat could be, and was, sold by sample, i.e., its quality could be judged by a fair sample shown to, and examined by, the buyer at the time of purchase. Immediately, however, the personal contact between buyer and seller was broken or became impossible—as in the case of wheat sold for overseas—then commercial trading standards became necessary in order to smooth out the difficulties incident to trading when long distances separated the seller and the buyer. Such standards are obviously essential in order that buyers who cannot inspect the wheat offered for sale may have indicated to them the **quality** of the wheat they may expect to receive after purchase in a **reliable, understandable and definite manner, and at the time the offer is made.** Here it may be stated the present Standard does not comply with these requirements.

Because of the necessity for the adoption of trade standards, which arose consequent upon the evolution of our wheat industry with its expanding production, trading by sample gave place to trading under the F.A.Q. Standard.

The F.A.Q. Standard, by which wheat is at present bought and sold throughout Australia, is so-called because the letters "F.A.Q." are the initial letters of the three words in the term "Fair Average Quality," and by custom have become recognised as the commercial abbreviation for that term, and also because, as far as is practically possible, it represents the **fair average quality of the crop of the particular season for which it is fixed.**

It is not known when the system of selling according to the F.A.Q. Standard was first introduced, but probably it originated in South Australia shortly after wheat was first exported overseas.

Although there is an independent standard for each wheat exporting State, the procedure adopted in fixing the F.A.Q. Standard is practically the same throughout the Commonwealth. As the standard fixed relates to

* Paper read before the W.A. Branch of the Economic Society of Australia and New Zealand, on 31st October, 1929.

the crop of a particular season only, it is necessarily fixed annually. Fixing this standard has been regarded, therefore, as one of the high rites of the commercial wheat world, by which the wheels of commerce are oiled, and the purchase and sale of wheat facilitated throughout, and beyond, Australia.

In Western Australia the fixing of the standards is undertaken jointly by the Perth and Fremantle Chambers of Commerce, who bear the whole of the expense in connection therewith, including the collecting of representative samples of wheat from wheat-growing districts. The actual proceedings take place in alternate years at the headquarters of each Chamber. Last season the standard was fixed in Perth; this season it will be fixed in Fremantle. The President of the Chamber, at the headquarters of which the proceedings are carried out is, for the time being, in charge of the function, and is assisted by leading wheat traders of the State, who comprise the grain committees of both Chambers.

As befitting such an important commercial proceeding, the work is carried out with scrupulous accuracy and attention to detail. Every possible precaution is taken to see that the weighings and calculations are absolutely correct and the mixing thoroughly done. The Chambers of Commerce are justly proud of the equitable methods by which the F.A.Q. Standard has been fixed each year. No effort is spared to make it a fair and just representation of the grain harvested and available for sale. The personal service, voluntarily rendered by members of the Chambers when fixing the standard, is worthy of great commendation. It is often laborious, and would surprise those who are not familiar with what is done. As the result of eighteen years' intimate association with the actual work of fixing the F.A.Q. Standard in Western Australia, it is unreservedly stated it is impossible to conceive of more careful methods being devised for its determination.

When the decision regarding the standard is made a declaration, as hereunder, is signed by the members and officials present. The declaration for last season read:—

> "We, the undersigned, present at the Chamber of Commerce, Perth, on Thursday, February 7th, 1929, at the fixing of the weight of the standard bushel of f.a.q. Western Australian wheat for season 1928-29, hereby certifiy that it was fairly taken, and the weight fixed, namely 62½ lbs. per Imperial bushel, in our opinion, is the proper weight for the season 1928-29."

It is pertinent at this stage to state that this Declaration does **NOT** comply with the requirements of a modern trading standard previously stated, viz., That it shall indicate the **quality** of the product in a **reliable, understandable and definite manner at the time the offer is made.**

It is signficant that the only detail in the Declaration, or definition, of the F.A.Q. Standard concerning its quality is that relating to its bushel weight. Because of the emphasis placed upon bushel weight in the official declaration, and the particular care taken to determine that of the current season's crop, not only in Western Australia, but in each of the exporting States, it is obvious that the declaration of the bushel weight is considered a reasonable and sufficient method of indicating to prospective buyers the information desired by them regarding the quality of the wheat available for sale, and also that it should play a very important if not vital part, in the settlement of disputes as to quality.

So much importance is attached to the bushel weight of the F.A.Q. Standard as to infer that it is the only information necessary to indicate its quality in a definite and understandable manner. This inference is based upon a misconception. It is fundamentally wrong, and may be entirely misleading, as may be seen from the following details relating to the two samples of wheat illustrated herewith; one of these illustrations represents the F.A.Q. Standard for 1928-29 and weighs 62½ lbs. per bushel, the other is a sample weighing 61½ lbs. per bushel, and, according to the inference to be drawn from the declaration of the F.A.Q. Standard, is the inferior sample. This,

F.A.Q. Standard wheat.
Bushel weight 62½ lbs.

Millable grain
97%

however, is not so, for the millable grain is identical with that contained in the F.A.Q. sample; the quality and bushel weight of the "dressed" or millable grain is exactly the same, and there is nearly 1 per cent. (.8%) more of it. The difference in the bushel weight of the F.A.Q. sample and the other is due entirely to the difference in the character of the unmillable material which they respectively contain. The bushel weight to be of real value, therefore, for indicating the quality of a particular parcel of grain should refer to the

"dressed" grain only. There could be no clearer proof than this that the natural bushel weight of a sample of wheat cannot be accepted in all cases as a reliable index of its milling quality.

Additional evidence on this point is furnished by the fact that, despite the meticulous care taken to ascertain and declare the bushel weight, it is considered of such **minor** importance by the arbitrators dealing with disputed claims that it is entirely ignored by them. The percentage of millable grain, its character and condition as indicated by its colour, brightness and

Commercial wheat.
Bushel weight 61½ lbs.

Millalbe grain
97.8%

The quality of millable grain is the same as that in F.A.Q. The bushel weight is lower than that of the F.A.Q. Standard because of the difference in character of the unmillable material.

soundness, are considered of greater importance than the bushel weight, though no reference is made to these characters in the official declaration. This view is confirmed by the following extract from the letter of a prominent London wheat firm to their Australian representative, as under—

* * * * * This is practically the only wheat which this year has been persistently penalised in arbitration, and there has been a considerable outcry amongst

shippers, as they consider that wheat weighing 65lbs., as the shipments do, cannot possibly be inferior to a standard which weighs only 63lbs. At the same time, the delivery samples undoubtedly have a grey appearance which is not the case with the standard, and whilst a little rubbing considerably improves the appearance of the delivery, we must confess quite impartially that in spite of this, deliveries are rather inferior to the standard.

In order to convey to the distant buyer definite and reliable information regarding the quality of the grain being offered to him it is necessary that the declaration regarding the F.A.Q. Standard shall not only state the natural bushel weight of the cleaned grain, but that it shall also include **definite information regarding the amount and character of the millable grain it contains.**

Owing to the lack of this necessary information arbitrators in Great Britain are compelled to base their awards, not upon the careful determination of the bushel weight of the grain in dispute by means of a suitable mechanical appliance, but upon their skilled judgment, after examining and comparing (i.e. matching) a sample of the disputed grain with the actual sample representing the F.A.Q. Standard. Presumably the matching, as in the case of wool classing, is to determine by skilled and trained judgment, the relative percentages and characteristics of the millable grain in the two samples. If so, it has to be admitted that such a procedure is much sounder than reliance solely upon the natural bushel weight, but it is still unsatisfactory, as will always be any method which relies solely upon the judgment, however skilled and unbiassed, of any individual.

The importance which has been attached to the declaration of the bushel weight is probably based upon the generally recognised belief that the cleaner the grain (i.e. the smaller the percentage of impurities, and other material unsuitable for milling, mixed with it) the greater will be its bushel weight. Evidence that, under certain conditions, this belief is **to some extent** well founded is furnished by the fact that the bushel weight of the current season's F.A.Q. Standard is increased by 1 lb., when the unsuitable milling material (3 per cent.) is removed from it.

A second misconception is that the F.A.Q. does represent, as many people imagine, the **Fair Average Quality** of the **Whole** of the crop of the season for which it is fixed.

Theoretically the F.A.Q. Standard **should be representative of the Whole** of the State crop. The joint Chambers make a very earnest attempt to ensure that this is what the F.A.Q. Standard shall be. It is, however, practically impossible to achieve this. Despite the special efforts which are made the Standard arrived at cannot be representative of the whole of our crop, but will represent **only** the quality of the wheat exported **prior to the end of January.** It will not represent either the wheat stacked at, or being carried to, country sidings. Some of this is likely to have been harvested late in the season, and may be weathered, dull, or even bleached. Futher, it is inconceivable that any disinterested person associated with the actual fixing of the Standard would allow the inclusion of samples of badly bleached, sprouted, or badly smutted grain.

The very nature of the Standard requires that a large proportion of the season's crops shall have been harvested before the Standard can be fixed, and, in consequence, the determination of the Standard has to be delayed for at least two months after wheat deliveries have commenced. This delay is unavoidable whilst such a Standard is retained. This feature was most unfavourably commented upon by the President of the Liverpool Corn Trade Association in March, 1923, when addressing the Australian editors then touring Great Britain. He pointed out that one of the troubles of the trade in Liverpool (which, of course, applied to other parts of the United Kingdom) was the delay which occurred in connection with the forwarding of standards of the new Australian crop. He further stated that it was then March, and the standards had not been received, although the cargoes sold according to those standards had arrived. This unsatisfactory phase of the matter is well illustrated by the quantity of wheat exported prior to fixing the F.A.Q. Standard during the 1925-26 season, for which figures are available. In that year it could not be fixed, as is usual, until nearly the middle of February and at that date 4,827,597 bushels, or 41 per cent. of the total quantity exported to the end of July, had been shipped, and by the time the sample was received in Great Britain this had increased to 63 per cent.

The F.A.Q. Standard, therefore, fails to comply with another requirement of a modern trading standard in that it is impossible to indicate, at the time the offer is made, the quality of the grain being offered to the overseas buyer. Overseas buyers are undoubtedly seriously inconvenienced by this drawback, which is unavoidably associated with an F.A.Q. Standard. The inevitable delay is a very probable source of friction between buyer and seller. It is reasonable to assume that this inconvenience is reflected in the price paid by the shippers of our grain, and that, in consequence, the grower does not receive its full value, or the higher price which could be paid if the risks now inseparable from trading under the present F.A.Q. Standard, and due to the inability to fix it at the beginning of the harvest season, were decreased as they can be.

Australia is in effect still trading in wheat by sample instead of, as is generally believed, by "standard," and the real position is that, prior to the receipt in Great Britain of the F.A.Q. Standard sample, buyers are to some extent "buying a pig in a poke," and trading in our wheat is only possible because past experience has taught them, within limits, what to expect. There is, however, a certain amount of uncertainty about the quality, for which a suitable margin must be provided.

As is quite in accordance with our tradition of British justice, buyers have the right to arbitrate in cases where they have a doubt as to whether the quality of the grain they are receiving is equal to that of the Standard. Arising out of this quite proper provision for the settlement of disputes, the purchaser of shipments bought prior to the arrival of the F.A.Q. in Great Britain invariably gives notice of his intention to arbitrate. In order to safeguard the buyer for the inconvenience and risk of having to purchase wheat during the greater part of the season according to a yet unknown standard the right to arbitrate has had to be extended to an unusual extent, and, in consequence, the claims for arbitration can remain in abeyance until

21 days later than the receipt of the F.A.Q. Standard sample. It can thus happen that final payment regarding the sale of a wheat cargo may remain in abeyance for three or more months after the sale has been made. Such a condition cannot be regarded as satisfactory, and it would be difficult to find any other commodity of importance subject to such trading conditions.

It is opportune now to draw attention to the economic unsoundness of this method of trading, and to call attention to the losses which occur

Unmillable material—foreign matter, chaff and back bone—found in the F.A.Q. and amounting to 0·6%. In a 50,000,000 bushel harvest this amounts to 8,035 tons.

Why pay freight and other charges on what is useless to the miller?

as the result of our adherence to it. If, as is contended, the fixing of the F.A.Q. Standard is based upon a misconception, then the first loss is incurred in the work involved in connection with its determination; the expense and trouble are, therefore, wasted. The amount involved is a few

hundred pounds, and as it is almost infinitesimal compared with the tens of thousands sterling lost in other ways associated with trading according to the F.A.Q. Standard, it may be ignored.

Some margin for contingencies in trading with wheat is recognised as necessary, but the uncertainty associated with the quality of the wheat, pending the fixing of the F.A.Q. Standard, and the probability, almost a certainty, of an allowance being granted against the shipper as the result of an arbitration—particularly if the price of wheat falls after the sale—

Fine unmillable screenings forming 2.4% of F.A.Q. wheat or amounting to 32,142 tons in a 50,000,000 bushel harvest.

Is it sound economics to pay freight and other charges on this and other unmillable material? It can be used to excellent advantage on the farm for stock feeding.

presupposes a special margin to provide for it. Assuming this special margin to be 1 per cent., though to one outside the trading circle it appears easily possible for the margin to be twice this, the loss to Western Australian farmers on a 30,000,000 crop would be £75,000, and to Australian farmers on 132,000,000 bushels—£330,000.

A further and extremely serious instance of the unsound economics of the F.A.Q. Standard is the lack of encouragement to farmers to utilise to the best advantage the engineering skill used in the construction of Australian harvesting machinery. Because of the excellence of this machinery it is believed, after allowing for difficulties inseparable from field work, that the grain can be so "dressed" or cleaned that no more than 1 per cent. of screenings or other unmillable material need be left in it. The F.A.Q. Standard allows for at least three times this amount, and, in consequence, many farmers now cover up or remove the tailing screens from their harvesters, whilst the more scrupulous ones allow them to become choked, thus deliberately lowering the commercial value of our main agricultural product by including a much larger percentage of unmillable material—foreign matter and screenings—than is necessary. This involves great economic waste. How great is this waste which permits unnecessary non-millable material in the standard will be seen from the following figures, which show the tonnage involved in handling different percentages of the estimated quantity of wheat sent to the Western Australian mills, and sea-board in 1927-28. A conservative estimate of the harvest handled that year would be 30,000,000 bushels, or 803,030 tons—

1 per cent. of this would mean	8,030	tons
2 per cent. of this would mean	16,060	„
3 per cent. of this would mean	24,090	„

or taking the 5.5 per cent. of unmillable material found in the F.A.Q. Standard for that season—1927-28- it would amount to 44,165 tons, or nearly nine full steamer cargoes of 5,000 tons each.

As already pointed out it is considered practical and quite reasonable to exclude all the unmillable material in excess of 1 per cent. from our commercial wheat. An estimate of the loss incurred in handling this unnecessary amount—4.5 per cent. in 1927-28, say, 27,000,000 bushels is as follows—

Export—say, 27,000,000 bushels, 4.5 per cent of which—1,215,000 bushels = 32,545 tons.

	£	s.	d.
Sacks—405,000 at 10s. per dozen	16,875	0	0
Cartage, say, 32,545 tons at 5s. per ton	8,136	5	0
Railway freight, say, 32,545 tons at 12s. per ton ..	19,527	0	0
Sea Carriage, say, 32,545 tons at 40s. per ton ..	65,090	0	0
	£109,628	5	0

That that is the case is indicated by the fact that the bulk of the wheat inspected for certificated cargoes and parcels during the early part of the current season and up to the middle of December, 1929, contains less than 2 per cent. of unmillable material and in consequence has the high bushel weights of 65 and 65½ lbs. It has been suggested that the improvement in quality is due to the salutary influence of the Wheat Bags Branding Act now operating for the first time; if so it shows the need for a little pressure or stimulus in order to ensure that our wheat growers shall use their excellent harvesting machinery to the best advantage.

In addition to this there is unnecessary expense or loss connected with the wheat used for local consumption in 1927-28 estimated to be 4.5 per cent. on 3,000,000 bushels—135,000 bushels—3,616 tons—

Home Consumption—	£	s.	d.
Sacks—45,000 at 10s. per dozen	1,875	0	0
Cartage, say, 3,616 tons at 5s. per ton	903	15	0
Railway Freight, say, 3,616 tons at 6s. per ton ..	1,084	16	0
	£3,863	11	0

	£	s.	d.
Export	109,628	5	0
Home Consumption	3,863	11	0
	£113,491	16	0

Though the percentage of unmillable material—5.5 per cent. on which the calculations have been based is the quantity actually contained in last season's F.A.Q. Standard it is admitted to be abnormally high, for the average for a number of years is about 3 per cent. In consequence it is fair to assess the normal loss in this connection on a 30,000,000 bushel harvest at about £50,000.

In 1917 Messrs. Scott and Winslow, of the Chemists' Branch, Victorian Department of Agriculture, made some investigations regarding the percentage of unmillable material found in Australian commercial wheat, and this was estimated by them to be 4.35 per cent. Using this figure it may be assumed that the unnecessary millable material amounts to 3.35 per cent. and the loss involved in connection with a Commonwealth crop of 74,000,000 bushels for export and 58,000,000 bushels used locally is as follows—

Export—	£	s.	d.
Sacks—826,333 at 10s. per dozen	34,430	0	0
Cartage, say, 66,400 tons at 5s. per ton	16,600	0	0
Railway Freight, say, 66,400 tons at 12s. per ton ..	39,840	0	0
Sea Carriage, say, 66,400 tons at 40s. per ton ..	132,800	0	0
	£223,670	0	0

Local Consumption—	£	s.	d.
Sacks, 647,666 at 10s. per dozen	26,986	0	0
Cartage, say, 52,045 tons at 5s. per ton	13,011	0	0
Railway freight, say, 52,045 tons at 6s. per ton ..	15,613	0	0
	£55,610	0	0

	£	s.	d.
Export	223,670	0	0
Home Consumption	55,610	0	0
	£279,280	0	0

This amount is stupendous and even supposing the amount of unavoidable unmillable material is reduced to 2 per cent. it approaches the startling figure of £170,000. It is too great to be passed over lightly in times like these, especially when to it must be added other incidental charges connected with the handling of this unnecessary material amongst our wheat, e.g. agents' fees, labour charges for stacking and the face value of the unmillable material for which the buyer may or may not pay, but which would undoubtedly have a value, and its best value, on the farm for stock feed. The economic loss is so great, and because most if not all of it is unavoidable, would seem to demand an immediate change in our Standard. This is especially so when the continuance of the present Standard has a tendency to increase the loss.

Apart from the fact that it does not and cannot be made to represent the F.A.Q. of the whole of the harvest the principal defects of the present Standard are—

(1) It cannot be fixed early enough for the requirements of the trade;

(2) Disputes as to quality are now dependent upon the personal judgment or opinion of a skilled individual, and

(3) It does not encourage the improvement that is possible and practicable in the "get-up" of our wheat crop.

The first defect, viz., the late determination of the Standard can be remedied by the adoption of a **permanent standard** which will operate from year to year.

Dissatisfaction will always exist whilst disputes as to quality rest solely upon the personal opinion of any individual, however skilled and experienced he may be. This is especially the case when the seller has no definite information, as at present, regarding the basis on which the arbitrator forms his opinion. Though it is admitted that, as the result of many years of experience, some men become remarkably skilful in assessing the relative values of two parcels of wheat, yet such a method is no longer in accordance with the progress which has been made in connection with our knowledge of wheat and its value for milling. During comparatively recent years a great deal of investigational work has been carried on in connection with the milling properties of wheat, and information is now available so as to provide a "technique" whereby the samples of the parcels in dispute can be dissected into their component parts, and their milling value, i.e., their commercial worth evaluated, in many cases on a much sounder basis, and to the disputants on a more satisfactory one, than an expression of opinion as the result of "matching." The dissatisfaction which now exists can be minimised by the elaboration of the Standard so as to include in the declaration now made, definite and reliable details regarding the amount and character of the millable grain in it as well as giving the bushel weight of the cleaned grain. With the inclusion in the declaration of such definite information it will be possible to remove much, if not all, of the dissatisfaction, which has always existed, and will continue to exist whilst a decision rests upon person judgment, however skilled and unbiassed it may be. With an extended declaration as indicated it will be possible to assist the skilled

judgment by simple and accurate tests, in much the same manner as the bushel weight of a small sample of wheat is determined, not by empirical means, but a specially devised instrument called a chrondometer.

The third defect associated with the F.A.Q. Standard can be remedied, and advantage taken of the excellence of our harvesting machinery, with a consequent improvement in the "get-up," which can be ensured to a greater extent than at present by providing that the Standard shall specify a smaller quantity of unmillable material than is found at present in the average of the F.A.Q. Standards, or it may be ensured completely by providing that the Standard shall refer to the millable grain only, as is the case with the Canadian standards. The latter plan will ensure, as any sound method should, "payment for quality," and is in line with the method of trading in cream and wool. In the case of cream, its value is based upon the amount of butter fat it contains; in the case of wool, upon the yield of clean scoured wool which can be obtained from the greasy product.

It will thus be seen that some of the defects associated with the present F.A.Q. Standard can be remedied by an elaboration of the declaration relating to the F.A.Q. and all of them by the adoption of a **permanent standard** which defines in an understandable manner the **amount** and **character** of the **grain** and **which limits the percentage of unmillable material.**

It is obvious that a change as suggested cannot be made without objections being raised to it. What are they? In the first place there is the unconscious objection to any proposal to disturb the existing order of things. This is founded mainly on the fear of the unknown which most of us possess and a preference "to trust the Devil we know rather than the Devil we don't know."

It has been said that trading according to a permanent Standard means trading according to a definition or formula and that this is impracticable. But is it? A definition or formula of the Standard agreed upon is neither more nor less than a description of the physical characteristics to which such a Standard shall conform. It is such a description or definition as might reasonably be expected, even under the present method, from a merchant seller by a prospective overseas buyer not familiar with the characteristics of the F.A.Q. Standard.

As showing that it is quite practicable to trade according to a definition or formula it may be stated that for several years the Chamber of Commerce were unable to give an F.A.Q. Standard for export oats, during which time there were several disputes and considerable trouble incidentally illustrating the need for commercial trading standards. Eventually, under the auspices of the Chambers of Commerce, the merchants met, and after consultation with the officers of the Wheat Branch of the Department of Agriculture, the following export **Standard for Western Australian Feed Oats** was decided upon. Its description is—

> "W.A. Standard Feed Oats shall be bright, sound and free from musty, smutty and other objectionable smell. It shall contain by weight not less than 96 per cent. of oats; not less than 14 per cent. of prime oats, and not more than 6 per cent. of screenings oats; nor shall there be more than 1-20th per cent. by weight of the seeds of "Speargrass.' The bushel weight shall not be less than 37 lbs."

Surely it cannot be said that any person familiar with the oat trade could not understand very definitely from such a formula what he was either buying or selling, or that, in addition, an examination of a physical Standard would be necessary in this connection or to settle disputes.

If further evidence be needed in this connection the experience of our officers of the Wheat Inspection Branch will provide this. Each year the cargoes conforming to the permanent "W.A. Standard White" are necessarily dealt with according to a definition or formula. Further, immediately the F.A.Q. Standard is fixed by the joint Chambers of Commerce it is now the practice of the Wheat Inspection Branch to set out its characteristics in a definition or formula, so that those responsible for the inspection may work according to it, rather than rely upon the actual comparisons which can be made with the physical Standard supplied by the joint Chambers of Commerce. Thus the whole of the wheat shipped under Government Certificate during the season just ended was dealt with according to a definition or formula. This fact represented by 14,200,000 bushels admits of no argument. Those of our inspection staff who have had experience of the wheat inspection work under both systems, that is—

(a) by comparison with a physical Standard, and
(b) by examination according to the definition,

are emphatically in favour of the latter and present method.

Further, it is pointed out that when the wheat submitted for certificate was dealt with under the old method of actual comparison with a physical Standard, and prior to the introduction of the present method of critically examining the grain to ascertain if its characteristics are as defined, there was infinitely greater dissatisfaction than at present.

The use of a definition does not, however, do away with the necessity for trained experience, such experience is still necessary to interpret properly the terms of the formula as understood by the trade.

It must be realised that the Standard is not so much one to which cargoes must conform in their entirety, but rather a means by which they can be evaluated, just as the varying dimensions of timber can be ascertained by means of a foot-rule. It is believed a distinct advantage, consequent upon the general use of a definition, with or without the help of a physical Standard, would greatly facilitate the adjustment of those differences in value due to variations between the wheat purchased and the Standard by which it was bought.

There is nothing unusual in having a fixed Standard. The great exporting countries of Canada and the United States of Amercia have them, and it is recognised to their advantage. Geographically Canada and the United States of America are more conveniently situated to the great wheat consuming centres than Australia, and yet both found it imperative and advantageous to adopt and market their wheat according to a system of permanent standards ("Grades"). Further, because of the greater diversity of types and varieties, these countries had far more initial difficulties to overcome in deciding what these permanent standards ("grades") should be, than Australia will have. The difficulties which both these countries had in deciding what permanent standards to adopt, and the number they are compelled to have, may possibly have caused some people to hesitate to advocate the adoption of permanent standards in Australia. There is, however, no real ground for hesitation.

The very fact, however, that the Canadian plan is to sell according to permanent standards is probably the main cause of the British objection to the change proposed. Associated with the Canadian Permanent Standard is the system of official certification as to weight and quality, and which is final at the loading port, and, in consequence of which, British buyers have no right of arbitration in connection with the purchase of certain grades of Canadian wheat, as they have with all Australian wheat. This phase is brought out by the Press report of an interview which the Hon. W. F. Dunn, Minister for Agriculture, New South Wales, when in England in 1925, had with the millers, and shows that they fear that if permanent standards were adopted in Australia they would lose the right which they possess under the present standards to submit claims to arbitration. That, however, would not be the case, and the adoption of a more definite standard would lessen the need for arbitration.

There is no wheat exporting country in the world which lends itself to the adoption of permanent standards under easier or more economic conditions than Australia. All the wheat States grow the same class of wheat under practically the same conditions, and the exportable surplus of each State is usually sold under the definition F.A.Q. This varies only sightly from year to year, and mainly in regard to the percentage of impurities it contains, which, in turn, influences the natural bushel weight. Thus a standardisation system suitable for one State would be suitable for all States.

Another objection not stated is undoubtedly that the adoption of a Permanent Standard involves a change in the mental attitude of those dealing with our wheat in the past. A Permanent Standard implies and requires a definition of its characteristics. Those in the wheat trade have been evaluating our wheat by the appearance of a physical standard, and any division into its component parts has been done sub-consciously. Some judges of commercial wheat become extremely expert in this direction; on examination of two samples they are able to say definitely whether one is better or equal to the other, but just why, they possibly are unable to say. It is true the new method at first would involve an entirely new outlook, similar to that required of a man who had previously dealt only in sovereigns or other metallic currency, who was suddenly asked to accept payment in notes, or by a perfectly sound cheque. This, however, need not be an insuperable objection, for if a sample of the Permanent Standard is considered essential, then it can be supplied. Herewith is an illustration of one of the Permanent Standards already existing in Western Australia. It is known as "**W.A. Standard White.**" It has been prepared from the season's wheat in accordance with the definition of same which is practically identical with the average F.A.Q. Standard for a number of years, and is as follows:—

W.A. Standard White Wheat.

The grain to be Sound and fit for Shipping.

Quantities—

Bright and Sound Grain	95.5	per cent.
Total Millable Grain	97.0	„ „
Total Foreign Matter	3.0	„ „

Bushel weight of cleaned grain—62 lbs.

Another objection brought forward is that because our wheat is in bags, it is impossible to deal with it according to fixed standards. This is not so. This idea has probably arisen because of a very general belief, in which the writer shared, that bulk grain is always cleaned from screenings and foreign matter on being received from the farmer or before de-

"W.A. Standard White,"
a sample made up in accordance with the definition, viz.:—

Bright sound grain	95.5%
Total millable grain	97.0%
Total unmillable material	3.0%
Bushel weight 62 lbs.	

spatch overseas. Bulk wheat, and the facilities at elevators enable this to be done, but the practice is anything but general. Except that bulk wheat can be sampled rather more readily than bagged wheat the procedure under a system of permanent standards would be the same with bagged as with bulk wheat, and would present no greater difficulty. This has been proved by the fact that this season over 14¼ million bushels, or over 58 per cent. of the total wheat exported, have been sampled at Fremantle as for a Permanent Standard.

It is also stated that the change would mean a drastic alteration of our present methods. This, however, is not so, the making of the change suggested would in no way interfere with or disorganise existing methods of dealing with the grain crop. The present method of buying from farmers by sample, and according to the judgment of the agent could continue, but, because of an accurate definition of what the standard consists, the adjustment of differences in case of disputes, either overseas or in the State, could be settled by skilled judgment assisted by simple and accurate tests, instead of, as at present, by personal though skilled judgment only.

Already there are two fixed standards for wheat in use in this State. One of these is known as the "W.A. Standard White." It was forced into existence by the requirements of certain sections of the export trade. This has been used for Government certificated cargoes each year for the past five years from the opening of the season until the fixing of the F.A.Q. Standard by the joint Chambers. Last season 7,546,116 bushels (202,128 tons) or 28 per cent. of the export wheat, was shipped according to this fixed standard, and in 1924 the proportion of the crop shipped under Government certification prior to the fixing of the F.A.Q. Standard was 61.3 per cent.

The other is the Standard by which the specially strong wheat of the "Comeback" type is sold. This Standard is not fixed each year as is the F.A.Q. Standard, nor has it ever been officially fixed. It has become recognised by custom, and except that the bulk of the grain is "horny or steely" instead of opaque or starchy it is similar to that of the "W.A. Standard White." Because of its superior milling quality, and because it commands a higher price, it has been called the "W.A. Premier Standard White."

There is nothing revolutionary in making a change in our wheat trading Standards; the change suggested is simply an ordinary evolutionary phase of our development.

Just as the F.A.Q. system supplanted a less suitable one, so it is believed that, because of our greater expansion, it is now desirable that our present F.A.Q. Standard, which has served its turn, should give place to a more modern one of trading according to permanent standards, a system which is more in keeping with the march of standardisation, and in line with the practice in other branches of commerce. It is believed that the first step in the evolutionary process is to elaborate the declaration issued in connection with the F.A.Q. Standard so as to include the percentage of millable material in it, together with definite information regarding its character.

THE VALUE OF THE POTATO SEED PLOT.

W. E. Collins,

Potato Inspector.

The use of seed plot combined with tuber selection is the most practical and effective measure for the production of disease free stocks known.

Degenerate diseases can be controlled, Fusarium Wilt may be held in check and the malformed plants and defective tubers caused by Rhizoctonia may be got rid of by the "seed plot" method of selection.

What is required, is that each grower should select when digging, the progeny from healthy, high yielding plants and reserve these for a special seed plot in the following season. The plot should be isolated, and planted quite separately from the commercial crop. The greater the isolation, the more certain will be the results.

During the period of growth, the plot must be given the utmost attention in the matter of eradicating all weakly and abnormal plants. By adopting this method each season, a system of continual selection would be carried out, and the progeny from undesirable and diseased tubers would be eliminated—so bringing the seed to a very high standard.

It has been clearly established that virus diseases, such as Mosaic and Leaf Roll, are carried from season to season in the seed tubers, and that infected plants do not recover, but their progeny reproduce the disease each successive year. It is also known that virus diseases are transmissible, and healthy plants, if surrounded by, or grown in close proximity to diseased ones, are liable to contract the disease by reason of aphis and other leaf-sucking insect attacks and show it the following season in reduced yields

If "rogueing" is carried out with extreme care and thoroughness and if insect attacks be prevented by spraying or dusting with a good insecticide, complete success should be possible.

Those growers in the Great Southern districts who grow for certified seed purposes, should remember that, though virus troubles may be comparatively slight there, large areas in the South-West require an annual supply of southern grown potatoes for seed, because of the rapid degenerate diseases engendered under the conditions existing, and the demand for seeding relatively free from Mosaic and kindred troubles will increase. Disease free stocks, therefore, should be retained and worked up for seed purposes.

The importance of preserving the foliage as nearly intact as possible must appeal to all intelligent growers. The leaves of the potato plant must be kept in a thrifty condition if a clean maximum crop is to be obtained. Both insects and fungus diseases should, and can be fought and conquered if the well known and thoroughly tested preventives are used. Remedies should not be delayed until the tops are badly injured. It is well known that the loss in a crop where the tops have been allowed to be devoured by insects, or fungal troubles to take hold, is heavy, the crop sometimes being scarcely worth the digging.

Unfortunately, with perhaps the majority of growers, nothing is done to destroy pests until the foliage is partly eaten, or the leaves become

covered with the spores of early blight. This is too late. By the time the remedies take effect, the tops are badly injured and the future crop much lessened.

Growers should not wait until this happens, but should be continually on the lookout for pests, and as soon as they appear an application of some remedy should be made.

It should be rememberd that spraying or dusting for controlling fungal diseases is a prevention, and not a cure. If the disease makes its appearance in the crop, before spraying is done, in most cases efforts after that will be next to useless.

Spraying or dusting for controlling insects, especially the Rutherglen Bug, should also be regarded as a preventive. Up to the present, home-made Bordeaux mixture or the commercial Bordeaux powder has been found to be the best for potatoes. With the addition of Arsenate of Lead (paste form), for the wet mixture and Arsenate of Lead (powder form), for the dusting—either makes an almost perfect control if the plants are thoroughly done. There are strong advocates for both the wet and dry mixtures. The dry powder applied with a dust gun, is certainly less laborious and quicker. It is claimed that seven acres of potatoes per day may be treated by this method, and it is gaining in favour with the large scale tomato growers of Geraldton and the market gardeners in and around the metropolitan areas.

If the best results are to be obtained, apply the powder on a calm morning, when the leaves are wet with dew or late on a still evening. It adheres better than the spray and will also be more evenly distributed.

Spraying may be done at any time when the weather is fine, and should be made every ten days or two weeks throughout the season in order to keep the new growth covered. The cost of spraying or dusting is not large compared with its many advantages. The crop will be increased, by increasing the effective area of the green leaves which manufacture the substances stored as potatoes. The rotting of tubers, both in the soil and in the storage, will, to a very great extent, be prevented. Therefore, proper spraying or dusting pays.

Early digging of the seed crop is another point for consideration, and one which is likely to contribute to success in obtaining and keeping seed free from Mosaic and kindred maladies. A certain period of time—it may be a short one—must elapse subsequent to inoculation with the virus, before the latter reaches every part of the plant. By early digging, therefore, it may be possible to secure healthy tubers from recently infected plants. A crop dug in an immature stage, is not exposed so long to disease infections as is one allowed to ripen completely.

To give effect to all that is suggested in this article, one must resort to wider planting. The distance between the rows should be such as to allow the grower easy access through the plants during the whole period of growth. "Pride goeth before a fall" it is said, and very often that nice-looking, even, closely grown crop of potatoes is its undoing.

The average grower hates to tramp into such a crop, and it is only on noting black patches or discolourations appearing, that he ventures to investigate. What can he do then? The very density of the foliage prohibits anything being done. It becomes a harbourage to insect pests, or fungal diseases and must be left to take its chance until digging time, entailing reduced yields, and the possible carry-over of disease infected seed.

PASTURES.

IN AREAS OF MEDIUM RAINFALL.

G. K. Baron-Hay,
Assistant Superintendent of Dairying.

PASTURE EXPERIMENTS AT BODDINGTON.

Considerable difference of opinion exists as to the most economical methods of establishing pasture, particularly Subterranean clover, in districts with an annual rainfall of from 20-25 inches. These experiments were inaugurated at the request of the Boddington Progress Association to demonstrate methods suited to the district.

The plots included three types of soil:—

(a) Light sandy loam, with clay at considerable depth, carry Stink bush and scattered Red Gum (E. calophylla);

(b) Light loam, overlaying clay at 9 inches, carrying Red Gum;

(c) Loam, overlaying quartzose hardpan at 12 inch to 15 inch, being a typical Wandoo (E. redunca var. elata) flat.

These types were planted on 27th May by the following methods:—

(1) 2 lbs. Subterranean clover per acre, drilled in with 60 lbs. of Algerian oats.

(2) 2 lbs. Subterranean clover per acre *broadcast* after the oats had been drilled.

(3) 1 lb. Subterranean clover per acre *drilled with* 60 lbs. Algerian oats.

(4) 1 lb. Subterranean clover per acre broadcast after the oats had been drilled.

1 cwt. of superphosphate was applied in all cases.

Results may be summarised as follows:—

(a) Wet Wandoo flats gave good growth, the growth being equally good when the Subterranean clover seed was broadcast or when drilled. These soils are unsuitable for crop growing.

(b) Very light sandy loam gave poor growth of both clover and oats.

(c) 1 lb. of seed gave quite a good stand, and where 2 lbs. per acre had been sown, and good growth followed, the clover had stifled the oat crop. This fact would have been accentuated had the normal quantity of rain fallen.

From observations, in this district and in others with similar conditions, the most economical method of establishing Subterranean clover is by sowing the seed with an oaten cover crop. For this purpose 1 lb. of good clean clover seed per acre is sufficient. Light sandy soils with no clay subsoil should not be treated.

The author has noticed that in light rainfall districts Subterranean clover often fails to bury the seeds, and there is a danger, if stocked the first season with sheep, that the seed "burrs" will all be eaten and a poor stand obtained the second year. On an average stand, the writer strongly recommends that the area be not stocked with sheep the first year.

Good results are not general in the lighter rainfall areas where the seed and superphosphate are applied to untreated land. Stirring the surface with a cultivator or sundercut is recommended before sowing.

WEST ARTHUR PASTURE COMPETITION.

There is no doubt that on the successful development of pastures in the districts surrounding Darkan rests the future prosperity of the land owners. The action of the West Arthur Agricultural Society in offering a prize for the best 10 acres of pasture is to be commended.

The useful rainfall up to the time of judging on October 25th was as follows, being particularly light in September and October, and 4 inches below the average for the season.

April	May	June	July	August	September	October
45	324	500	191	173	86	64

In spite of the dry spring, however, good stands of pasture were seen, long enough to be cut for meadow hay.

The following Table gives the results of the competition:—

—	Yield. 45	Freedom from Weeds. 15	Useful Grasses. 15	Freedom from Disease. 15	Evenness of Growth. 10	Total points. 100
E. L. Walker, Bokal ...	45	13	10	15	9	92
A. C. Cummings, Darkan ...	38	13	12	14	7	84
W. J. Wunnenberg, Darkan ...	32	11	11	14	8	76
E. J. Clugston, Bokal ...	34	10	8	14	5	71
H. Harrison, Bokal	22	10	8	14	9	63
H. C. Pobjoy, Duranillin ...	22	11	12	11	5	61
F. Wood & Son, Darkan ...	22	10	10	14	5	61
F. B. Horwood, Darkan ...	16	11	10	14	9	60

The winning crop owned by Mr. E. L. Walker, Bokal, demonstrated that, even in an unsatisfactory season, good Subterranean clover yields can be obtained on Wandoo flats. Under the old system of crop growing, these flats were looked upon as of little value but are now proving the best areas for the growth of Subterranean clover.

This area was established in 1925 by Mr. Walker, using 5 lbs. of clean seed per acre on ploughed ground, without a cover crop. The area was topdressed in April with 90 lbs. superphosphate, and again in early September. This latter dressing, however, had not yet been washed into the soil.

Mr. Walker favours a heavy dressing of seed, claiming that a heavy growth is obtained the first year. It is doubtful, however, whether the larger area sown with 1½ to 2 lbs. seed per acre is not more profitable. This latter is the system most practised, and two good stands of clover established by this method was exhibited by the second prize winner, Mr. A. C. Cummings, Darkan. This plot of 20 acres was established by using ¾ to 1 lb. clean seed, without a cover crop but on scarified soil three years previously.

Mr. Cummings now has 1,400 acres sown with Subterranean clover at the rate of 1 lb. of seed per acre applied with a drill, without ploughing, using an autumn and spring dressing of 90 lbs. superphosphate. The results are excellent, showing the suitability of this clover to the average lands in the district.

From the results of the competition, it may be inferred that:—

(1) Subterranean clover will thrive on the Wandoo flats hitherto not considered valuable.

(2) May be established by scarifying the ground, using 1½ to 2 lbs. clean seed with 1 cwt. superphosphate per acre.

(3 A second topdressing with superphosphate is warranted where meadow hay is to be cut.

Mr. E. L. Walker, Bokal—The winning crop of Subterranean Clover.

CHEAP PASTURE PRODUCTION—NORTH DRAKESBROOK.

A series of experiments were designed two years ago to demonstrate economical methods of establishing pasture on the wet sandy loams, overlying clay at varying depths (up to 2 feet), which soils are general in the country between North Dandalup to Wagerup.

These experiments which were conducted at North Drakesbrook, at the request of the North Drakesbrook Progress Association, have yielded some valuable information during the two years they have been in existence.

The experiments were designed to shed light on the following points, all of which are of interest to local farmers desiring to bring this type of country into production.

Ploughed versus Unploughed Land.

The land in question is too wet in the winter to grow a crop, and it was found that, although the growth of sown plants was good on all plots, growth was noticeably greater on the unploughed than on the ploughed land.

Where ploughed the land was rapidly water-logged, and it would have been quite impossible to graze stock on it during early spring. This could have been done on the unploughed areas at any time during the growing period.

From the results obtained, the cost of ploughing here is not warranted.

Fallowing did not give a better growth the first year than when sown on freshly ploughed land.

Ploughing to a depth of 2 inches only "puddled" the land as much as where it was more deeply ploughed, and did not have the desired effect of killing the scrub. It is preferable therefore, where ploughing is carried out to do the work thoroughly.

Plants to Sow.

The following mixture of plants was sown on May 19th, 1928, on cultivated ground, to demonstrate the plants most suited to this type of soil.

Subterranean clover	4 lbs.
Crimson clover	1 lb.
White Dutch clover	1 lb.
Paspalum dilatatum	5 lbs.
Cocksfoot	5 lbs.
Lotus major	1 lb.
	17 lbs. per acre

Superphosphate—200 lbs. per acre.

Results have shown that for the quick establishment of pasture on this land, no legume or grass approaches Subterranean clover in the early stages of development.

There are indications, however, that Lotus major, White Dutch clover and Perennial Rye grass will all have a place in any pasture mixture sown some years after initial development, when the soil has become more fertile.

Clean Seed or "Burr."

In order to demonstrate the relative results from clean seed and "burr" seed, when sown on land without cultivation, clean seed was broadcast at the rate of 4 lbs. per acre which was calculated to supply the same amount of seed as that contained in the sample of "burr" used.

During the first season and also at the time of writing, there was no decisive difference between the growth of the area sown with clean seed and that sown with "burr." Seeding was carried out in mid-May.

Demonstration Plots on Mr. O. Bowles' farm, Waroona, to show relative merits clean subterranean clover seed and "burr" for sowing on uncultivated land. (Left: Seed in "Burr." Right: Clean Seed.)

As already pointed out in a previous article (Journal of Agriculture. March, 1929, page 171), equally as good results can be obtained from clean seed as from "burr," and with a number of definite advantages.

The use of clover seed in the "burr" is only recommended where the farmer has gathered from his own fields, and is thus certain that no undesirable weed seeds or pests are in evidence.

In this district, with its ample rainfall, 3 lbs. of clean seed are recommended when sowing on unploughed country.

VARIATION IN THE WEIGHT OF EGGS.

W. T. Richardson,
Poultry Adviser.

Inheritance in poultry covers a multitude of factors, amongst which the grade of egg is one of the most important. It is only of recent years that size of egg has been receiving attention from poultry breeders, and any improvement obtained has been the result of selective breeding. The size of the egg being a recessive factor, selective breeding must be practised not only to improve the size of egg, but to maintain any improvement obtained, otherwise reversion to the small egg will follow, and years of good work may be wasted.

We generally breed from second season birds and over which, as a rule, lay larger eggs than birds in their first laying season—as a matter of fact the maximum size of egg is generally not reached till a hen is in its third season. In selecting eggs for incubation the common practice is to reject any eggs under two ounces in weight, and no doubt large numbers of such eggs are discarded. In principle this is quite the correct procedure, but in actual practice it leads nowhere. We hear from candid poultry farmers that, although they do not put an egg under two ounces in their incubators, their production of undersized eggs is excessive. Here is where inheritance comes in. What did their stud birds do in their first laying season, and what was the size of egg laid? If they laid small eggs, what can we expect their progeny to do but inherit the small egg factor from the parent stock? As for the sire, he may very likely be bred from a bird with similar characteristics to those of the hens he has been mated with and he, therefore, has not the power to help check the small egg propensity of his strain in his progeny.

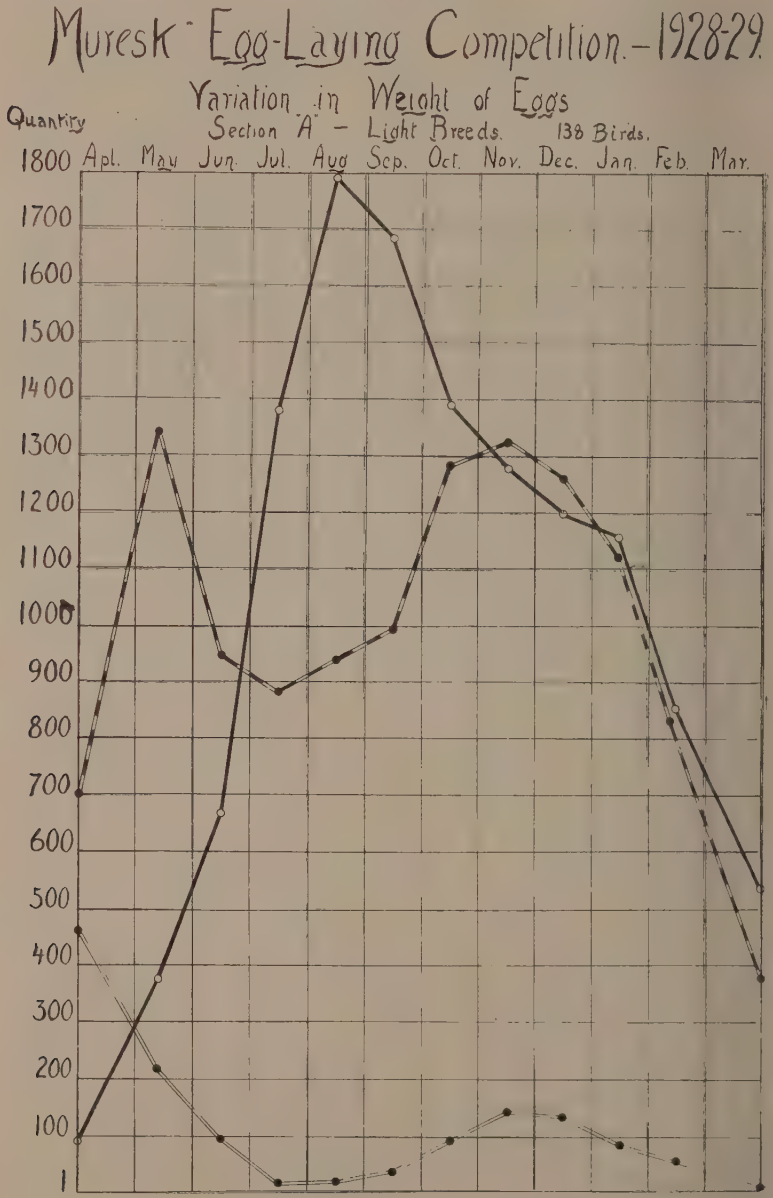
The main consideration when breeding for size of egg, and this should be the aim of all poultry farmers, large or small, is to know the performance of their prospective breeders in their first laying season, so that they may be rejected or kept for the following season's breeding operations according to their performance. This object cannot be attained unless a number of pullets are tested either in single pens or by trap nesting.

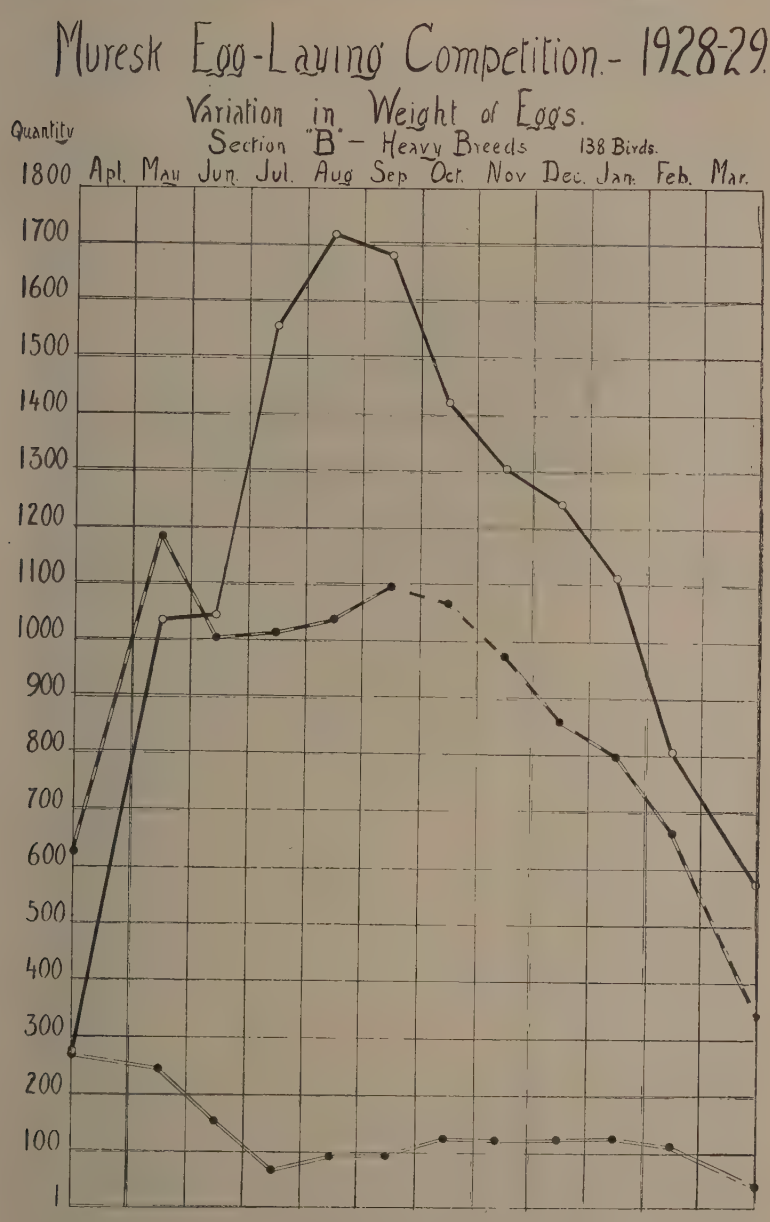
The variation in the size of eggs laid by individual birds throughout their first season is very pronounced, and has various tendencies, and only by testing our pullets can we learn our lesson.

The following graphs have been prepared and based on the results obtained at Muresk Egg Laying Competition, 1928-1929, in which a total of 276 birds were entered. One graph refers to Section "A," comprising 138 birds, all White Leghorns. The thick lines indicate two-ounce eggs and over; the black and white lines, eggs weighing under two ounces but not less than one and three-quarter ounces, and the double lines, eggs under one and three-quarter ounces. For the purpose of this article these shall be referred to as first, second, and third grade respectively. The marginal figures under the word "quantity" relate to the number of eggs laid, and the month during which they were laid is shown by the discs on the various broken lines.

We find that during April the 138 birds in question laid, in round figures, 90 first-grade eggs, 700 second-grade eggs, and 470 third-grade eggs. In May their performance was 375 first-grade eggs, 1,345 second-grade eggs, and 215 third-grade eggs, and so on.

A glance at the chart will show that after May, when the second and third grade eggs are declining rapidly, the number of first-grade eggs increases very considerably, with the result that in August we have the peak production of first grades. Then their numbers reduce, till in November more second grades than first grades are laid.





Graph No. 2 refers to Section "B," comprising 138 birds, *i.e.*, 132 Black Orpingtons and 6 Rhode Island Reds. Here again we see the same tendency, that is to say, an increase in the number of first-grade eggs, till the peak period (August) is reached, when their numbers decline rapidly.

The fluctuation in grades may be attributed by some to the influence of climatic conditions at Muresk. This, however, is not the case, because the same fluctuation has been noted every season in eggs submitted for export which are produced in a number of districts. August and early September produce a larger percentage of 16lb. packs than October and November.

On the other hand a number of birds carried a more uniform size of egg during the term of the test and, therefore, did not show any decline in first-grade eggs after August.

Table No. 1 gives a detailed performance of the winners of the competition in question, a team of six Black Orpingtons. None of these birds had commenced laying before their arrival at the Competition. Here we have five birds, consistent layers of first-grade eggs, and one bird (No. 94) following the general trend to decline in egg size after the noted peak period.

A few Black Orpingtons and White Leghorns are given in table No. 2, showing the individual decline in grade of egg after the August-September period.

Tables Nos. 3 and 4 have been prepared, giving in detail the range of the variation in weight of every egg laid by individual birds during the respective months of the Competition. The first one relates to a White Leghorn (No. 9) and the latter to a Black Orpington (No. 64). This is the general trend, more pronounced in some birds than in others.

The above graphs and charts clearly indicate that single testing without recording the weight of every egg laid is of little value to the breeder, as all he learns is that his birds laid a certain number of eggs with no indication of their grade. How can we breed for size of egg without having a detailed performance of our stud birds? Averages taken during given weighing periods will not help in that direction, as Tables 2, 3 and 4 readily demonstrate. Every day during the term of the Test should be part of the weighing period.

Only by single testing, recording the weight of every egg laid, discarding from our breeding operations birds as shown in table No. 2, and concentrating on those as detailed in table No. 1 (bird No. 94 excepted), shall we, after a few years of such breeding, relieve our markets of the large quantities of undersized eggs, which have a detrimental influence on the price of the product of the hen.

TABLE No. 1.

MURESK EGG-LAYING COMPETITION 1928-1929.

Grade of egg laid by the winning Team of six Black Orpingtons.

—	Bird No.	2ozs. and over.	1¾ ozs to under 2ozs.	under 1¾ ozs.	Bird No.	2ozs. and over.	1¾ ozs. to under 2ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.
April.	91	...	...	...	92	...	...	...	93	...	2	...	94	1	3	1	95	...	...	...	96	7	2	...
May	...	17	1	...	...	16	4	...	...	19	1	...	...	5	20	...	...	14	3	...	...	16	...	...
June	...	23	1	...	...	23	...	...	...	15	...	...	...	10	13	...	...	17	...	...	...	7	...	...
July	...	21	...	...	...	19	...	...	...	21	...	...	...	14	6	...	...	20	...	...	...	18	...	...
August	...	22	...	...	...	8	...	...	...	20	...	...	...	10	10	...	...	22	...	...	...	13	...	...
September	...	20	...	...	...	17	2	...	...	23	...	...	...	19	2	...	...	22	...	...	...	19	...	...
October	...	24	...	...	...	21	...	...	...	20	...	...	...	5	7	...	...	18	...	...	...	25	...	...
November	...	19	...	...	...	21	...	...	...	21	...	...	...	5	14	2	...	23	...	1	...	23	...	...
December	...	22	...	...	...	18	...	...	...	20	...	...	...	2	10	1	...	20	...	1	...	21	...	...
January	...	8	...	...	...	11	1	...	...	20	...	...	...	2	1	...	...	7	...	...	...	21	...	...
February	...	20	...	...	...	10	...	...	...	17	...	...	...	...	6	3	...	17	...	1	...	18	...	...
March	...	12	...	...	...	4	...	...	...	11	...	...	...	5	2	...	...	10	...	...	...	11	...	...

TABLE No 2.

MURESK EGG-LAYING COMPETITION, 1928–1929.

Grade of Egg laid by Individual Birds.

	Black Orpingtons.								White Leghorns													
	Bird No.	2 ozs. and over.	1¾ ozs. to under 2ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.
April	118	5	4	...	107	...	2	...	89	6	5	3	47	1	11	1	78	1	1	1	56	...	1	...
May	...	4	19	...	...	20	...	...	...	14	8	...	...	10	10	...	...	...	6	2	...	2	6	...
June	...	13	3	...	...	18	1	...	...	22	...	...	...	16	2	...	...	7	4	...	...	1	moult	...
July	...	15	1	...	...	17	2	...	...	23	...	1	...	20	...	...	...	6	1	1	...	21	...	...
August	...	16	...	...	...	23	...	...	...	24	...	...	...	21	...	...	...	16	2	...	...	20	...	...
September	...	13	5	...	...	21	3	...	...	22	1	...	...	23	1	...	...	20	4	...	...	19	3	...
October	...	10	11	...	...	15	9	...	...	21	4	...	...	14	10	1	...	11	14	...	...	12	9	...
November	...	4	10	2	...	13	13	...	...	21	4	...	...	7	20	...	...	4	21	...	...	13	11	...
December	...	3	15	2	...	10	17	...	...	16	9	...	...	4	21	...	...	...	24	2	...	8	14	1
January	...	3	7	1	...	7	16	...	...	6	18	...	...	3	19	...	...	3	10	...	...	10	13	...
February	...	...	9	...	...	6	10	...	...	6	14	...	...	5	14	...	...	5	10	...	...	2	5	...
March	...	10	...	...	...	4	5	...	...	6	5	...	...	7	6	...	...	6	2	...	...	mo	ult	

Table No. 3.

MURESK EGG-LAYING COMPETITION, 1928–29.

Bird No. 9—White Leghorn.

Variation in Weight of Eggs laid.

	Ounces to 1 dozen eggs.										
	Under 1¾ ozs.		1¾ ozs. =			2 ozs. =			2¼ ozs. =		
	19	20	21	22	23	24	25	26	27	28	29
April ...	...	1	2	2	6	...	...	...	...	...	...
May ...	...	...	...	...	4	10	6	...	...	...	...
June ...	...	...	...	...	3	4	7	4	...	...	...
July ...	...	...	...	...	2	9	7	5	...	...	...
August ...	...	...	...	...	1	8	13	1	...	...	...
September	...	...	...	...	5	11	6	1	...	...	...
October	...	...	...	1	6	10	5	1	...	...	...
November	...	...	1	3	6	9	2	...	...	...	...
December	...	...	8	10	1	1	1	...	...	...	...
January	...	...	5	11	4	1	...	...	...	...	...
February	...	1	2	3	1	1	...	...	...	...	...
March ...	...	...	2	6	1	1	1	1	...	...	...

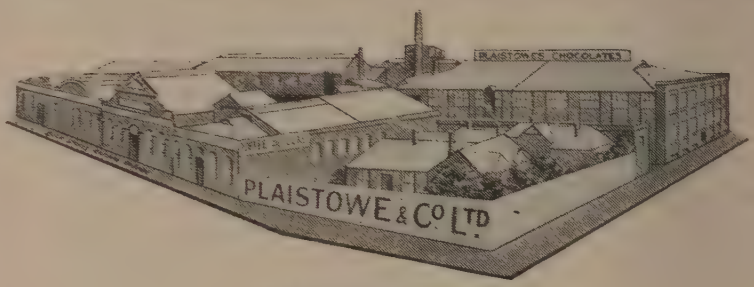
Table No. 4.

MURESK EGG-LAYING COMPETITION, 1928–29.

Bird No. 64—Black Orpington.

Variation in Weight of Eggs Laid.

	Ounces to 1 dozen eggs.										
	Under 1¾ ozs.		1¾ ozs. =			2 ozs. =			2¼ ozs. =		
	19	20	21	22	23	24	25	26	27	28	29
April ...	1	1	...	2	...	1	1	...	...	...	...
May ...	...	...	...	1	12	9	...	...	...	...	...
June ...	...	...	...	...	2	1	...	...	...	...	...
July ...	...	...	2	...	6	8	2	1	...	...	...
August ...	...	...	...	...	...	8	9	4	...	...	...
September	...	...	...	...	2	10	9	...	...	1	...
October	...	...	1	1	7	9	4	1	1	...	...
November	...	...	1	2	8	5	4	...	...	...	...
December	...	...	3	2	10	7	...	...	...	...	...
January	...	...	...	5	4	...	...	...	...	...	...
February	...	3	...	3	5	1	...	...	...	...	...
March ...	...	...	...	2	...	...	...	...	...	...	...



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Milk Chocolates
Confectionery
Lemon Peel
Icing Sugar

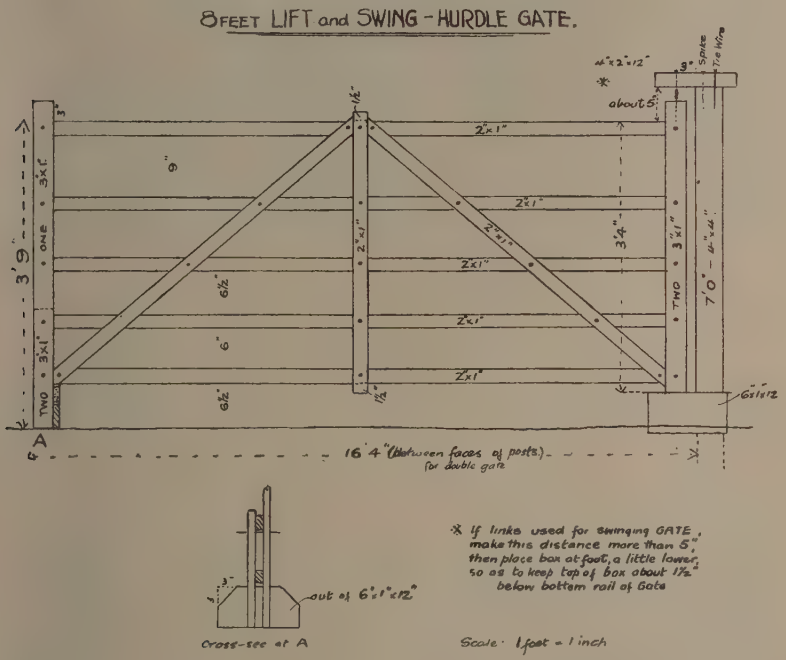
FULCREEM BRAND

Custard Powder
Blanc Mange Powder
Cakies
Cake Flour
Health Saline
Lemon Squash Cordial

4—4

A LIFT-AND-SWING HURDLE GATE.

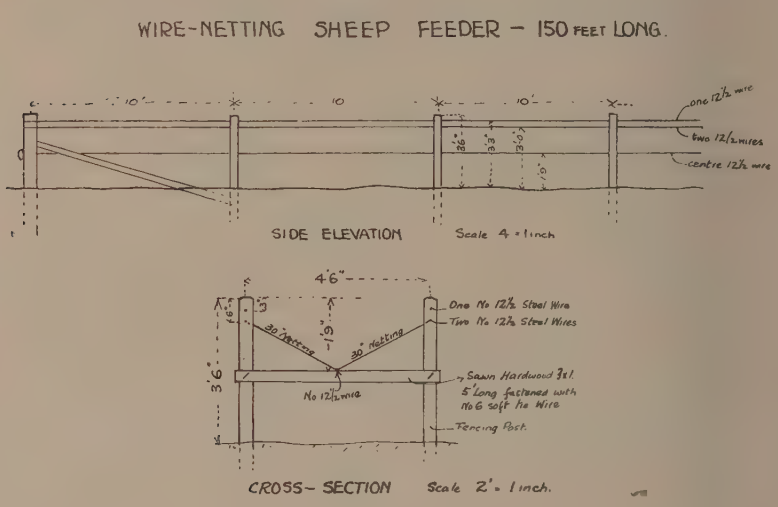
While on a recent visit to the Gnowangerup district the writer had the opportunity of seeing a gate and a wire sheep-feeding trough, both of which appeared of sufficient interest to warrant bringing under the notice of readers of the "Journal of the Department of Agriculture." With this end in view photographs and details of these were obtained, and are submitted in the hope that they will prove of benefit to our farmers.


8 FEET LIFT and SWING - HURDLE GATE.
4"x2"x12"
9" Space
about 5"
2"x1"
3'9"
3"x1" ONE
3"x1" TWO
9"
6½"
6"
2"x4"
3'4"
7'0" - 4"x4"
6"x1"x12"
16'4" (between faces of posts) for double gate
A
* If links used for swinging GATE, make this distance more than 5", then place box at foot, a little lower, so as to keep top of box about 1½" below bottom rail of Gate
out of 6"x1"x12"
Cross-sec at A
Scale: 1 foot = 1 inch

The gate is of very simple design and especially useful for openings where it is unnecessary to keep it continually closed. The two outstanding advantges are, firstly, the simplicity with which it is hung by means of a chain from a support on top of the post, and secondly, the foot attached to the meeting stile of the gate, which ensures it remaining open in whatever position it is placed. This useful pair, as illustrated, were seen on the holding of Messrs. R. Formby & Sons, Ltd., and grateful acknowledgments are due to Mr. R. Formby for the sketches supplied.

THE WIRE NET SHEEP-FEEDING TROUGH.

In view of the recognised advantages of supplementing the natural pasture during our summer months, the sheep-feeder illustrated herewith will be of particular interest, as it is suitable for feeding a large number of



sheep with a minimum of inconvenience to the stock, and without waste. By the use of this feeder, as will be seen, long hay can be fed, and the sheep are able to reach the hay from all sides and underneath without difficulty.

Wire Net Sheep Feeding Trough I.

A very considerable tonnage had been fed through this feeder and there was not seen any indication of waste around it. Particular attention is directed to the type of netting used, which after some experience and trial Mr. Formby

Wire Net Sheep Feeding Trough II.

found most suitable for the purpose. It is 14 gauge, 3in. mesh, and is known as boody-rat netting. Another point of note is the economic length, 50 yards, which is just sufficient to use up a 150ft. roll of netting.—*The Director.*

Lift-and-swing Hurdle Gate.

MARKET GARDEN HINTS.

E. T. Morgan,
Vegetable Inspector.

Mistakes are common to mankind; this applies no less to the vegetable grower than to any other class of the community. Whilst visiting market gardens in the metropolitan area, I have met growers who have been doing what they thought the right thing, but who were doing it in quite the wrong way. In at least three instances I have seen growers liming land, then turning it over and planting seed, together with blood and bone manure and other nitrogenous fertilisers. If the action of lime is understood it will be realised that this is a great mistake. Lime should never be applied to soils together with manures containing sulphate of ammonia or blood and bone, as in these cases great losses in nitrogen occur; lime liberates the nitrogen contained in the mixture; it then passes into the air and is lost. If applying lime to soil, do so at least three or four weeks before the application of other fertilisers. The majority of growers are alive to the benefits to be derived by liming the land, and much more of it could be used than is at present.

While it is true that lime is one of the elements essential to plant growth, it is usually found in cultivated soils in sufficient quantities for direct plant feeding. The great benefit derived is through its action in releasing other forms of plant food, particularly potash, from the insoluble forms in which it occurs in the soil. Lime is also important in a soil containing large amounts of organic matter, as it corrects the acidity of such soils and enables nitrifying bacteria to thrive and do their work in bringing the nitrogen of organic matter into available form for direct plant feeding. Lime is also a preventive of the disease known as club root of the cabbage, turnip, etc., which occurs in acid soils.

Unfortunately lime has been found to bring about conditions that have been favourable to the organism that causes scab on potatoes, and while the resulting crop may be larger, the market value is reduced by reason of the scab. It would be advisable to lime land a year previous to planting potatoes. Lime lessens the cohesiveness of clay soils, and increases that of sandy soils; in fact there are few soils the mechanical texture of which is not improved by liming. Lime will never make poor land rich if regarded simply as a manure; but used aright, there is no means available to the man on the land that more efficiently aids in building up the productivity of the soil.

Recently a crop of potatoes came under my notice which appeared stunted and showed lack of vigour. Upon inquiry I found that these had received heavy dressings both of stable and artificial manure. The stable manure had been applied at the time of planting, and blood and bone fertiliser had been used as a top-dressing about a fortnight after the potato plants had appeared through the ground. As the phosphoric acid and nitrogen in this fertiliser are fairly slow acting and as top-dressing is applied for its stimulating effect on the crop, it will be seen that it quite failed to answer the purpose for which it was employed. Had the blood and bone been applied at the time of planting with sulphate of ammonia as a top-dressing at the period when the plants were showing through the ground, the results would have been much better. This has been proved out by a successive crop which was treated in this way.

It will often be noticed when harvesting carrots and parsnips that a number of them may be malformed or forked. This is invariably caused by too shallow cultivation and also by having sown the manure too close to the surface. If the land has been thoroughly and deeply cultivated, and the manure well worked into the soil, this will be corrected. The carrot and parsnip, when well grown, are deep rooted plants, and where the soil is at all hard it does not allow of proper root extension. If the fertiliser is deeply worked into the soil the root will tend to go down after it. The root hairs of plants have mouths and I think they must have noses too; it has been noticed that when a heap of stable manure has been placed at some distance from a fruit tree, when the manure has been removed, upon digging down, a mass of fibrous roots have been encountered, much more than on the opposite side of the tree. Hence the supposition that their noses enable them to scent the manure and to reach greedily after it. The same thing applies to deep rooted plants, and where the fertiliser is deeply placed the root will endeavour to reach it.

In tomato culture, growers are becoming more and more convinced of the necessity for some kind of trellising or support for the plants. Allowing plants to roam all over the ground with the attendant risk of attack by numerous insect and fungus pests is gradually giving way to some method of support for the plant. This enables the grower to thoroughly dust or spray the plants for the control of these pests, which is impossible when plants are trailing along the ground. The fruit is also much cleaner, as in case of rain tomatoes near or on the ground get soiled and have to be washed before being packed for market.

Dusting for the control of various pests is gaining favour amongst metropolitan growers, as it is claimed that one man can do about four acres in a day as against one acre or less with a knapsack spray pump, a great saving when attacks by insect pests are noticed.

A mistake often noted, in the case of root crops, is the need for greater thinning of the plants. The young plants come out of the ground, if fairly thickly sown, so close together that they necessarily compete with each other for space in which to spread their leaves and roots, and for water and plant nutrients. If some of the plants are not removed, leaf development will be hindered, roots will be small and twisted about each other and the crop unmarketable. The grower realises this and thins out, but quite a number of growers do not seem to like the idea of being too drastic in this direction, with the result that many of the roots are too small for sale, and these have in turn not allowed of the maximum growth of their brethren. Crowding of plants in the seed-bed for future transplanting is also not conducive to the best stand possible.

The writer was, on one occasion, shown two patches of cabbages, both planted out on the same day. One patch was planted from a bed in which the plants had been sown thinly in drills, and the other one from a seed bed in which the seed had been broadcast. Both seed beds were planted on the same day, and although the plants were of similar size when lifted, the difference in growth was phenomenal at the time of observation, and those planted from the drilled seed bed were easily three weeks in advance of the others as well as being much better quality. In the case of early cabbages, say about April or May, this may mean a big difference when prices are dropping. It certainly pays to give plants sufficient room to allow of their full development.

WAX SCALE.

(*Ceroplastes Ceriferus*, Anderson.)

By L. J. Newman, F.E.S., Entomologist; B. A. O'Connor, B.Sc.Agr., Agricultural Adviser; and H. G. Andrewartha, B.Sc.Agr., Agricultural Adviser.

Order—Hemiptera. *Family*—Coccidae. The Coccidae, to which the scales all belong, are a widely diversified group of insects. The word Coccids is derived from the Greek Kokkos, denoting a rich red dye, which was procured from a scale insect now known as *Kermes vermilio*. Later, this scale, as a source of dye, was overpowered by the discovery of the group of dye-producing scales known as the Cochineal insects.

Scale insects when introduced into a country without their natural checks, and where the climatic conditions are favourable, become very serious pests and injurious to vegetation. The milder temperate zones, such as our local climate, favour their increase.

Fortunately some species have only one generation per annum, and this condition applies locally to the Wax Scale.

Taking scales generally, they can be roughly divided into the following groups:—

1. Those which attack only deciduous plants or trees.
2. Those which attack evergreen plants or trees.
3. Those which live only on the bark.
4. Those which live both on bark and leaves.
5. Those covered with hard shields or scales.
6. Those covered or protected by a cottony or waxy secretion.
7. Those which are naked.

The Wax Scale comes under Groups 2-4 and 6.

Generally speaking, scale insects are hatched from eggs which are minute oval bodies of varying colours laid under the body of the female. In some few species, however, the eggs are hatched in the maternal abdomen, and the young produced alive. When first hatched or born, they appear as minute insects, oval in outline, the body flattened and indistinctly marked off from the head. The head is provided with a pair of minute eyes, antennae

and a delicate sucking apparatus, consisting chiefly of long fine threads. For some time after emerging from the eggs, they crawl about actively with their six legs, seeking for a suitable location on the food plant in which to insert their rostra or beaks. Having done this they at once commence to form the protective scale or covering over the body. In most species, once they have fixed themselves by their mouth parts to their host plant, they never again move from this position, where they live their lives through imbibing the plant sap. When finality of position is determined, it is usual for the female scale to shed its legs and antennæ, as it has no further use for them. In the case of the males, they go through a series of comparatively quick changes, emerging as fragile winged insects, equipped with antennæ, eyes, legs, and one pair of wings.

The males do little or no damage to the plants, and consequently can be overlooked from an economic point of view.

The females continue to grow, and finally reach maturity. Their bodies become filled with eggs which they lay under the scale covering, the parent dying soon after this act has been accomplished. There seems to be no other aim in life than the perpetuation of the species.

Coccids or scales naturally increase very rapidly, if permitted, owing to the large predominance of females. They are largely protected by the waxy tests with which they cover themselves, and which appear to render them more or less unpalatable to most insectivorous birds.

It would almost seem that nature had combined to assist these insects. There is, however, under natural balanced conditions, a very important check provided in the form of other minute insects, chalcid wasps, etc., which prey upon or live within the bodies of the scales, destroying vast numbers.

Parasitic fungi also play an important part in their control.

It is when these insects are introduced from other countries without their natural controls that we have to suffer seriously from their ravages, as they increase to plague form. Under such conditions, we are forced to take artificial measures for their suppression, keeping always in view the possibility of biological control.

The harm done by sucking insects is often not appreciated till it is too late. The scales may be observed on the tree or plant in considerable numbers; but as long as the tree shows no marked injury, the majority of people are inclined to believe that but little harm has been done. They appear to overlook the fact that a tree, in the same way as a human, may put forth every possible effort to sustain itself against the attack, and apparently succeed in doing so, only to collapse in the end. Every living scale, when established upon a plant, constitutes itself, so to speak, an automatic pump, drawing the vital fluids from the host plant by means of its hair-like beak. The amount insects are capable of drawing from a tree in this way is truly surprising.

This fact is illustrated by the showers of honey dew which many sucking insects give off. The strain upon a plant or tree by sap imbibing insects is greatest when the soil moisture content is at its lowest, and when

the greatest amount of transpiration is taking place through the leaves, which is during the months of January to March. Therefore, if a tree has to carry myriads of these insects, it stands to reason that the tree and its fruit will greatly suffer.

Another serious result which has to be reckoned with is the effect of the honey-dew given off. This sweet sticky secretion spreads over the leaves and fruit, preventing the normal respiration and development of the tree.

Then, following on the presence of this honey-dew, there always appears a black fungus growth, commonly known as Sooty Mould or fumagine (*Capnodium spp.*).

This grows upon the sticky secretion, and is in no way parasitic upon the plant. Indirectly, however, it does considerable harm, because it clogs up the leaf stomata or breathing pores, and covers the fruit with black smut. This entails considerable labour in the cleaning of the fruit before marketing, and the process of this cleaning injures the keeping qualities of the fruit.

Get rid of the scale, and if no Aphides are present, the black smut will disappear.

Associated with the damage due to the absorption of the plant juices by the scale, there often follows a killing of the plant cells, caused by the irritation excited by the beak of the insect, or by the injection of some toxic fluid.

Scales belong to the group of sap suckers or Haustellate insects. It follows, therefore, that the application of a poison foliage-spray such as arsenate of lead would be useless, as the food is drawn from beneath the surface of the leaves. Such insects can only be destroyed by a contact spray or fumigation. The action of a contact spray is to either destroy by a caustic effect, or by stuffing up the breathing spiracles, by varnishing or waxing over with an air-proof film.

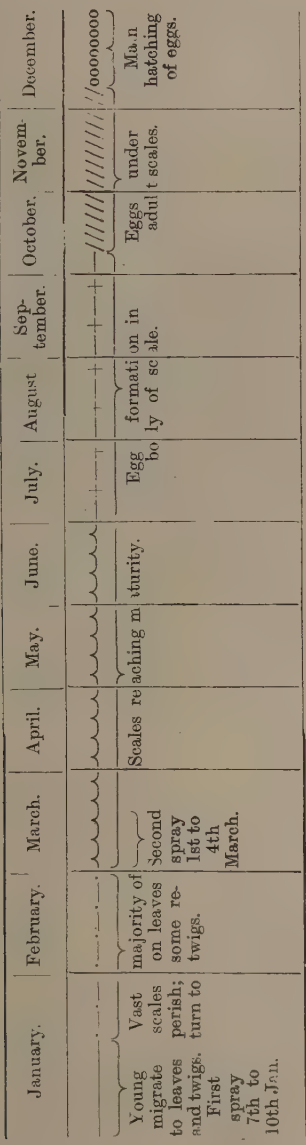
To be able to take effective and timely measures of control against the Wax Scale, we must have an intelligent appreciation of its life history and habits. To this end a careful and systematic study of the scale under local conditions, both in the field and laboratory, has been undertaken during the past 20 months.

The members of the Genus Ceroplastes are chiefly confined to the tropics. The Indian Wax Scale, the one under discussion, has become more or less cosmopolitan, and was introduced into Eastern Australia as far back as 1897. Its record in this State dates back to March, 1911, where it was discovered infesting a few citrus trees in the Kalamunda district. It was undoubtedly brought in on imported citrus trees from Eastern Australia.

Fortunately its spread has been very limited, being almost entirely confined to the same district in which it was first reported. In 1925 the district inspector discovered that a native plant known as *Sollya fusiformis* was carrying this scale. Since then an isolated outbreak has been reported on one or two other native plants such as the Ti-tree and Christmas tree.

Occasionally Apricot, Pear and Persimmon trees in proximity to infested citrus have been found slightly affected.

LIFE HISTORY.



The Eggs.—These are microscopic, oval, pinkish objects, measuring .32 m.m. or 1/70th of an inch long and .14 m.m. or 1/180th of an inch wide. (Block 1.)

Each female scale is capable of laying from 900 to 1,000 eggs, indicating its wonderful powers of reproduction.

In our observations over two seasons we have definitely proved that there is only one generation of eggs produced, but there is individual variation in egg development and hatching.

Some scales commence laying the first week in October, others at intervals throughout until the first week in December. All scales have deposited their eggs by the 7th December.

In taking these observations we found that before all the scales had laid, 30 per cent. of the first eggs laid had hatched, but were still living under the protection of the parent scale. For a period, the young scales, after hatching, remain under the mother, and appear to go through their first moult. The irregularity of the coming to the age of egg production accounts for the mistaken opinion that there are several generations in a year. Naturally, with a difference of two months between the laying of the first eggs and of the last, there will be a corresponding difference in the date of hatching. If, therefore, eggs which were laid during the first week of October, hatched during the first week in December, eggs which were not laid until the first week in December would probably not hatch until the first week in February.

Undoubtedly, the main issue takes place between the 20th December and the 7th January. The first treatment is, therefore, recommended to be applied on or about the 7th to 10th January. Those scales, which issue later, arise from eggs laid by a few belated females in December, which constitute a carry-over brood necessitating, if good control is desired, a second treatment at the end of February.

The Larvae.—The young naked six-legged wax scales were first observed to have issued from under the parent scales on the 20th December. These, in the main, crawl on to the leaves, where they select a temporary abode. Here they insert their rostra or beaks, and imbibe the plant juices. They at once commence to construct their typical waxy coverings. These are composed of a central oval covering, consistently surrounded by 13 delicate processes, four on each side, three on the posterior or hind end, and two on the anterior or head end, which gives them a very characteristic appearance. (Block 2.)

These young retain their legs, as three weeks to a month later, those that are living, migrate back to the young wood. Large numbers appear to die on the leaves, and in the process of returning from the leaves to the wood many are blown or fall to the ground, where they perish. (Block 3.)

It is doubtful if 10 per cent. of those which emerged finally settle down and reach maturity.

By the end of January the bulk of the scales have settled down into their permanent position on the young wood, shed their legs, and never

again move. About mid-February the shape of the waxy covering begins to alter. The dome-shaped central portion becomes pointed, giving somewhat the appearance of a clown's cap. (Block 4.)

Later, further pointed secretions of wax appear, which finally spread and form a complete covering, hiding the delicate processes seen during the first stage. (Block 5.)

All scales observed upon the tree are females, the male of the wax scale not having been discovered.

After reaching the adult stage the scales continue feeding and become fertile, eggs being developed in the maternal abdomen. This development of eggs continues for a period of three months. In mid-July, upon dissecting the scales, these eggs were discernible. From October and onwards to the first week in December, eggs are laid under the enveloping scale or waxy covering of the female, the parents dying when the young issue. (Block 6.)

The adult scale is about a quarter of an inch in diameter, formed of an irregular mass of wax, of a somewhat uniform pattern, slightly crimped on the edges and rounded on the top. The wax is at first almost pure white, but eventually becomes covered with dust and fumagine. The actual living coccid with the scale covering removed is top-shaped, rounded at the head, tapering to a point at the posterior. The under surface is flattened, and attached to the bark of the tree. In colour it is of a uniform dull red, and measures about 2½ lines or 1/5th inch in length. (Block 7.)

TREATMENT.

Owing to the nature of the scale's covering, which is formed of a waxy or greasy exudation, and which protects the otherwise defenceless body, it is difficult to destroy when in the adult stage. To obtain effective results by spraying, it is obvious that this must be done when the scale is in the young and defenceless stage, before the waxy test has been fully developed.

The fact that the citrus trees are evergreen renders spraying more difficult.

It also limits the strengths at which the various sprays can be applied without injury to the foliage. (Block 8.)

Times to Spray.—The careful study of the life history of this scale has revealed that the most vulnerable period is when the young have just issued. The main swarm comes forth between the 20th December and the 7th January; supplementary swarms occur between the 7th January and the end of February.

The most effective times, therefore, to spray are about the 7th to 10th January, and again at the end of February.

What to spray with.—If spraying is done at the periods advised, any good contact oil spray will prove effective. Oil sprays are not by any means as efficient as soda, if applied when the waxy covering is well formed.

The standard home spray, and one that probably gives the best general results, is that known as the washing soda solution. The formula recommended is ¾ to 1 lb. of washing soda to the gallon of water. If scale is very young, the ¾ lb. strength will prove effective. For more advanced scale use the 1 lb. strength. If preferred, soda ash may be used at half the washing soda proportion.

The action of the soda appears to be corrosive, eating away the wax and leaving the young coccid exposed and dead. In the use of the soda wash it is necessary to see that as little as possible of it reaches the ground, owing to its evil effect upon the chemical and physical condition of the soil, and its damaging effect to the roots.

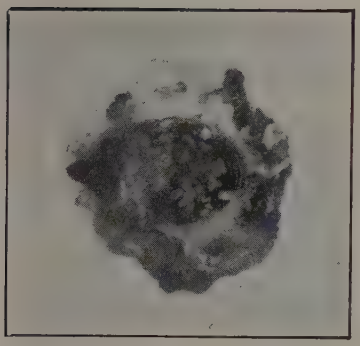
Whatever the spray used, it is essential to see that the work is done thoroughly, care being taken to ensure that the inside of the trees as well as the outsides, and the under as well as the upper sides of the leaves are thoroughly coated.

In the use of any contact spray, it must be understood that it is only those insects which are brought into contact with the killing agent that are destroyed.

Experiments with various sprays during October were made, with the view of finding out whether a spring treatment before the eggs were laid would yield better results than spraying later in January and February, when the eggs had hatched

The results were disappointing, the intense waxy covering then present offering too great a resistance. Further experiments in regard to times of spraying are to be conducted.

Biological control.—During our investigations it was found that a small percentage of the scales were attacked by the larvae of a chalcid wasp. The controlling effect was, however, negligible. So far we appear to lack any effective natural enemy.

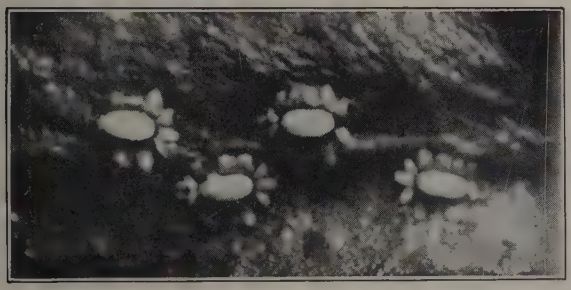


Block 1.

Eggs under parent scale.
x 10. (Original.)

Block 2.

Typical young scale two weeks old. x 25. (Original.)



Block 3.

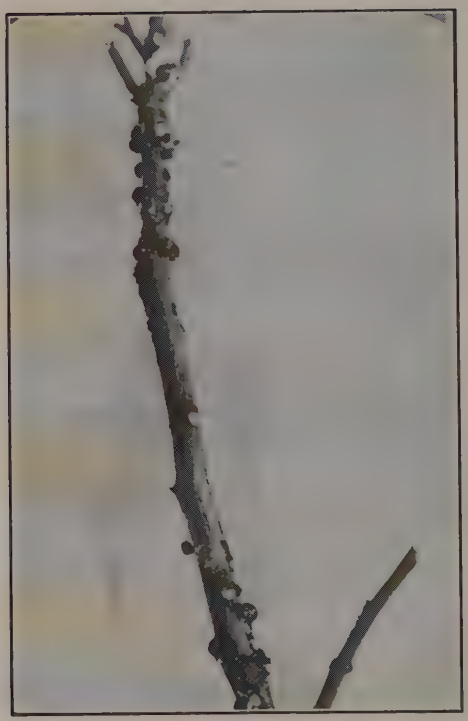
Young on leaf two weeks old.
x 12. (Original.)

Block 4.
Twigs showing scale two months old.
(Natural size.) (Original.)

Block 5.
Scale 2½ months old.
Natural size. (Original.)

Block 6.
Full sized scale.
Natural size. (Original.)

Block 7.
Adult Coccid, with waxy covering removed.
x 12. (Original.)



Block 8.

Group of scales with wax removed.
Natural size. (Original.)

HORTICULTURAL NOTES.

Geo. W. Wickens,
Superintendent of Horticulture.

The saying that "in the Spring a young man's fancy lightly turns to thoughts of love" may be paraphrased with reference to orchardists to read that "in the Spring the fruitgrower's fancy seriously turns to thoughts of what will the harvest be?" From the time when the buds commence to swell until the fruit is set constitutes a period of anxiety that only those who are intimately acquainted with the industry can adequately appreciate. So many things may occur—Thrips, Frost, Hail—to name only three out of many—changing a promising start into a bad finish. But the records of fruit crops for many years past show that while light crops alternate with heavy crops in the various seasons, a failure is unknown and two light crops in succeeding years is an extremely rare occurrence.

Last season stone fruits were under the average: this season in the majority of orchards there is a super-crop. Last season's pear crop was medium: this year it is from good to heavy. The apple crop last season constituted a record: this season it is light. The grape crop last season was good: this season it is again a good one. The citrus crop last season was under the average and present indications are that in the coming season the trees will yield plentifully, but it is too early yet to know what proportion of the young fruits now on the trees will shed and what remain to ripen.

The spring will have changed to summer by the time these notes are published and whether the crop be light, medium or heavy, fruit harvesting will then constitute the main occupation of fruitgrowers. To obtain the best results on the market great care should be exercised in grading and packing so that when any case is opened up the fruit in that case will be found to be of one size and quality.

The light crop of apples will mean a great reduction in the quantity exported compared with last season, but some shipments will be made and it is hoped last season's experience in the bad results attending the export of immature fruit will prevent any of that description being forwarded again, either in the coming or any subsequent season.

Though the winter rainfall this year was under the average in the fruitgrowing districts more than usual has fallen in November and cultivation to loosen the surface and prevent loss of moisture has needed constant attention, but the rain has been very beneficial in causing the trees to make strong growth and the orchards at the present time—November—are a beautiful study in green.

The abundant crop of early apricots will afford an excellent hopping off place for fruit flies this season, and growers should exercise the greatest care in destroying all infected fruits. All fallen fruit should be gathered up, not once or twice a week, but once in every 24 hours. By doing this and attending to baiting and trapping the pest will be kept

under control, but if neglect is shown in the early season's fruits the pest will increase, in a heavy stone fruit season like the present, to plague form by the time the mid-season fruit is fit for market.

No trace of Codlin Moth has been seen in the State since January last, and there is every reason to believe that Narrogin now as well as Collie has been freed from the pest, but all apple and pear growers must remember that it may be introduced in goods from the Eastern States at any time, and the Department should be notified at once if any fruit is found showing evidence of having been tunnelled by a caterpillar. If the pest is discovered in the early stages of invasion our experience has shown that it can be, and is, completely wiped out: but it would be a long fight with a doubtful issue if Codlin Moth had a few seasons' start in a district before steps for its eradication were taken. Western Australia is noted for the hearty co-operation of fruitgrowers and the Department in working for the benefit of the industry, and it is only this co-operation that has enabled Western Australian apple orchards to remain free from Codlin Moth.

STACKED LUCERNE HAY.

An interesting record of remarkable preservation of lucerne hay is given in the "Farmer and Settler" of the 4th October last, in which the writer points out as follows:—

> "When Mr. Andrew Phipps, of North Richmond, acquired his farm he stacked some hay. That was twenty-seven years ago, and there is about five tons of the fodder left. The stack is well roofed, but the sides are exposed to weather. After cutting in about six inches the other day the hay was found to be in perfect order—sound, sweet and green, and with leaf adhering to the stems. Mr. A. D. Playfair, Vice-President of the Royal Agricultural Society, who witnessed the cut, said that he had never seen a better lot of hay in his life."

"CONCRETE ON THE FARM."

(By Courtesy of the Swan Cement Company.)

Every day concrete is being more extensively adapted to all phases of our industrial life, and it is being more and more appreciated by the progressive farmer that by its use his work becomes easier and cleaner and increased production is the inevitable result. Farming is becoming more and more an exact science, and only good methods which will stand the test of time are considered as satisfactory to-day.

The strength of concrete can be made to suit all requirements, so that there is not a structure that could not use concrete, plain or steel reinforced, with advantage. Once a floor or wall is built in concrete it should be there for all time. Let us remind you that the old historical aqueducts built during the Roman Empire are standing to-day, a monument to the permanence of concrete—and there is no reason why the simple structures about the farm should not be just as sound and durable.

There is no great skill demanded. In fact, by following a few simple rules, any practical man can carry out a first-class job at the first attempt.

In addition to being strong, durable, and easily handled, concrete is quite a cheap form of construction. The only materials required in addition to the cement are sand, broken stone, and water. All of these can generally be obtained in the locality. The timber forming needed during the placing of the mass is recoverable and can always be used again elsewhere. Then, after the work is finished, it will cost nothing to keep the job maintained in perfect order and condition.

It is, in addition, proof against fire and weather, white ants and vermin, and may even be made proof against acids and other chemical reactions.

Of the many uses to which concrete may be applied, we suggest the paving of paths and yards, the floors to dairies and piggeries, the construction of water tanks, silos, troughs and bins, sheep and cattle dips, fence posts and drains, and a hundred and one other items too numerous to enumerate.

No better pavement can be put down in the stock yard or anywhere carrying heavy traffic. Mud and dust are entirely forgotten and a concrete pavement is readily cleaned down. Where water is plentiful it may be hosed down, and by having suitably arranged side gutters, the waste water is led away to a properly constructed cesspool or manure pit. Where water is not available, the pavement can be regularly swept down with a hard broom, and the rain depended on to wash it down occasionally. This hard sweeping or washing will never wear out the surface as it would with other pavements, and the result means that cleanliness is easily maintained, which must be reflected in the health and hardiness of the stock. It has furthermore been established that the manure recovered in this way is rich in plant food—much richer than that taken from the old-fashioned earth yard. Then, if it is led through concrete gutters to a well constructed pit, none is lost and the quantity recovered is naturally much greater.

Probably the dairyman has led the way in the use of concrete on the farm All up-to-date milking sheds have concrete floors, and many use in addition feed manger and alleyways constructed in the same material.

The dairy itself has a cement floor and the result is a sanitary condition, which protects the milk and the cream from spoiling, as was so often the case when the old earthen or wooden floors were in use. Moreover, the

quality and quantity of produce is much improved when the stock are well cared for, and it is recognised to-day that well constructed water tanks and troughs, stalls and mangers, and clean yards are essential if first-class condition is to be maintained in the herd.

Then the problem of the preservation and storage of fodder is answered by the use of concrete silos and bins. The elimination of wooden floors and walls to the barns goes a long way towards keeping down the mice and other vermin, and thereby saving a great deal of wastage and pollution of fodder that is so often met with. With the present high prices, every saving means money, and the thinking farmer cannot afford to overlook consideration of these facts.

CONCRETE.

(*What it is.*)

Concrete—a manufactured stone—is made by mixing together with water, Portland Cement sand and stone (or gravel). Various proportions are used, depending on the use to which the concrete is to be put. About an hour after mixing these materials together, the mass begins to stiffen, until, in from half a day to a day, it becomes so hard that you cannot dent it with the hand. By a month the mass is hard like stone—indeed, harder than most stones.

In large construction jobs, where great strength is required, the proportions of the mixture to be used is gone into very carefully so that the greatest strength can be obtained from the materials available. The greatest strength is obtained when there are little or no voids in the resulting concrete. This mixture is rarely obtained as the voids in each load of stone and sand vary a little, so in order to be absolutely safe it is as well to use a little more cement than will just fill the voids. For general work it has been found that a mixture containing 4 parts of stone, 2 parts of sand and 1 part of cement gives a very strong concrete—this is commonly called a 4 : 2 : 1 mix. In explanation of the term "voids" used above, the following may be of interest.

If we imagine a square box measuring 1 yard in every direction filled with broken stone, one can plainly see that however tightly we pack the stones in there will always be some empty spaces (or voids as they are termed) left between the stones. Methods have been devised whereby we can ascertain the volume of these spaces and thus obtain the volume of sand required to fill them up. It will be seen therefore that this quantity of sand can be put into our yard cube box *as well as* the broken stone. Likewise it will be seen that in the sand there are also a great number of smaller voids to be filled up and it is these spaces that have to be filled with cement which is ground extremely fine to fulfil this purpose. If then we ascertain the volume of the voids in the amount of sand required for our broken stone, we know the quantity of cement that will be required; and it will be seen that this cement *will also* go into the same box. Therefore, using a 4 : 2 : 1 mix, as mentioned previously, the following quantities would be required to make 4 cubic yards of concrete:—

4 cubic yards broken stone.
2 cubic yards sand.
1 cubic yard cement.

THE ESSENTIALS OF GOOD CONCRETE.

To obtain success in concrete work, the great essentials are:—

(1) that the materials be perfectly clean and sharp, the best of their respective kinds;

(2) that they be thoroughly mixed in proportions carefully determined, and

(3) that the cement be used fresh, or if it must be stored, that it be not exposed to the passage of moist air.

In fixing the quantity of materials required for a given job, calculate the cubical contents of the concrete work when completed and provide the same number of yards of stone. It will be found that the sand is absorbed without adding to the measurement, and it will also be found that wastings and leavings will about equal the bulk of cement that is afterwards added.

Materials for Concrete.

Before describing the actual process of mixing and placing concrete, it will be as well to have a clear understanding as to the nature of the materials to be used, and how these are best selected.

Portland Cement.

Cement is sent from the Factory in Bags, each bag contains approximately 125 lb. of cement, as 18 bags go to make up one ton.

It is important that the cement be stored in a dry place. Once wet it becomes hard and lumpy, and in this condition it is useless. If however, the lumps are caused by pressure in storing, the cement may be used with safety. Lumps thus formed can be easily broken by a blow from the back of the shovel. In storing cement, place a few wooden blocks on the floor and lay boards over them and then stack the cement on top of them, covering the pile with a tarpaulin. Never, in any circumstances, keep cement on the bare ground, or stack it directly against the outside walls of buildings.

Sand.

Do not use very fine sand. If there is a large quantity of fine sand handy, obtain a coarse sand and mix the two together in equal parts, this mixture is as good as coarse sand alone. Besides being coarse the sand should be clean and free from vegetable matter. The presence of dirt can generally be detected by rubbing a little on the palm of the hand. Another method is to fill a fruit jar to a depth of about 4 inches with sand and then fill to the top with water. After the jar is well shaken, the contents should be allowed to settle for about two hours. The sand will sink to the bottom, but the mud which can be easily recognised by its colour, will form a distinct layer on top of the sand. If the layer of mud is more than one half inch in thickness, the sand should not be used unless it is first washed. An easy method to wash sand is as follows: Build a loose platform about 10 to 15 feet long, with one end about a foot higher than the other. On the lower end and sides nail a piece of 6 x 2 timber on edge, so as to hold the sand. Spread the sand over this platform to a thickness of about 3 or 4 inches, and wash with hose. The washing should be started at the higher end and the water allowed to run through the sand and over the 6 x 2 piece of wood at the end.

Stone or Gravel.

This is known as the "coarse aggregate" of the concrete and care should be taken in its selection. The pebbles of gravel should be examined to see that there is no clay on their surface. The presence of a film of clay around the stones prevents the "binding" of the cement. If necessary the gravel can be washed in a similar manner to that described for sand.

The size of stone or gravel to be used will be governed by the form of construction contemplated. For foundations or any large structure anything from ½ inch to 2½ inch in diameter can be used. For thin walls, ¼ inch to 1 inch stones should be used.

Mixing.

The mixing of concrete should be thorough; this is as important as the proper proportioning of the concrete and the use of good materials. All ingredients should be carefully measured or weighed. A convenient form of measure for the sand and broken stone is a box without top or bottom, or a barrel with the bottom and top knocked out may be used. It is better to apportion the cement by weight, though the size of the measures used for the coarse material can be so adjusted as to permit a sack of the cement to be taken as the unit for that material. A wheelbarrow of known capacity is another unit of measure on small jobs. Water may be measured by a pail. To use a hose requires some little experience and care on the part of the person handling it, lest the Portland Cement and sand be washed away from the larger parts of the coarse material; moreover, the water cannot be measured by this method.

The concrete should be mixed as near to the place where it is to be used as practicable, for if left standing for any length of time it may set and become useless.

No concrete which has begun to set should be allowed to be beaten up and re-used under any circumstances whatever. Nevertheless, concrete that has begun to set may be treated as a coarse material if mixed with a fresh proportion of sand and Portland cement.

The measured materials should be spread out on a clean wooden bench, or stage, if the mixing is to be done by hand. If much mixing is to be done the stage should be covered with a thin piece of sheet iron or zinc plate. The sand should first be measured and then spread in a layer of even thickness.

The Portland Cement should next be distributed over the surface of the sand and the whole turned over dry with the shovel until the two materials are seen by the uniform colour to be thoroughly mixed. The coarse material should now be thrown over the mixture, and the whole turned at least three times dry and three times after wetting. It is better to add the water a little at a time until the right consistency is obtained, than that it should be thrown on all at once. The best manner in which to apply the water is by means of a rose-head to a watering can, which must be filled from the measured pails.

It is inadvisable to lay down any definite rule as to the percentage of water to be used in mixing concrete, owing to the varying conditions which obtain, such as weather and the nature of the coarse material and sand used in each particular case. The strength of plain concrete increases as the amount of water used in mixing is decreased, this being more particularly the case during the earlier stages of the maturing of the concrete.

Therefore, for mass concrete, it is usual to require that the quantity of water added to the other constituents shall be only just sufficient to bring water to the surface after thorough ramming, which ramming should make the mass quiver. In reinforced concrete, particularly in such portions as may contain a lage amount of reinforcing bars of the like placed closely together, it is essential that the concrete should be sufficiently wet to pass between the reinforcing bars and to thoroughly surround every portion of the steel, though not so wet as to allow any dripping of the cement, water and sand. This should be ensured at the expense of having the concrete wetter than would be otherwise desirable. Where the reinforcement is not very closely spaced it is unnecessary for the concrete to be so wet. In dry or hot weather, the quantity of water should be increased in order to allow for evaporation. Other conditions being the same, the drier the concrete the more quickly will it set and mature. This is of importance when there is any danger of green concrete being attacked by frost. The wetter the concrete, the greater is the tendency to contract during the process of setting and maturing.

Water.

Water for Concrete should be clean and free from strong acids or alkalies. If you are in doubt as to the purity of the water available, make up a small test block and see whether the cement "sets" properly.

It has been proposed by Lieut. Sankey, R.E., in "Engineering," that the following specification be made for concrete:—"The percentage of voids in the selected aggregate is to be found, and the sand and cement are to be added to make sufficinet mortar of the quality x sand to one cement to fill the voids + 20 per cent.—where x is the ratio of sand to cement."

The proportion of voids to the aggregate may be ascertained by filling a water-tight box of known dimensions with the material, and measuring the quantity of water poured in, so as to fill up the interstices. The amount of voids in 1 cubic yard of aggregate is given in the following table:—

	1 cubic yard contains voids amounting to
Stone broken to 2½-inch gauge	10 cubic feet
Stone broken to 2-inch gauge	10⅔ „ „
Stone broken to 1½-inch gauge	11⅓ „ „
River ballast (which contains the necessary sand)	4½ „ „

Watch the Details.

The newly mixed concrete should be placed in the forms within thirty minutes after it is mixed. As it is being placed in the forms, it should be tamped or spaded. This operation makes the concrete dense and improves the surface.

Tamping.—The concrete is tamped in with a light rammer, or worked down with a small blunt spade to relieve any confined air, the spade being worked on the flat against the forms: this works back any large stones, and brings the matrix to the face, making a smooth job. In ramming, do not use a flat-face rammer of large area, it does not work the matrix through the aggregate.

Drying or Seasoning.

The forms should not be removed until the concrete has set. This will vary according to the dampness of the concrete and the weather. If there is no pressure, the forms may be removed in about twenty-four hours: but

in the case of a retaining wall, the forms should be left in position for three or four weeks on the side furthest from the bank. The concrete wall should be damped frequently to prevent too rapid drying, and the top of the wall should be covered with bags.

Protect and Cure Carefully.

Newly placed concrete should not be allowed to dry out. It should be protected from sun and drying winds or the water necessary for the proper hardening will evaporate, resulting in a loss of strength. Floors, walks, and similar surfaces can be protected by covering with moist earth, sand, hay or straw, as soon as the concrete has hardened sufficiently so that the surface will not be injured. This covering should remain for a week or ten days and be kept moist by occasional sprinkling.

CONSTRUCTION OF SOLID WALLS.

Frames or Moulds.

In building solid concrete walls *in situ* it is necessary to have movable forms or moulds. These are made of boards about one inch to 1½ inches thick—the boards should be well braced by stout cross-pieces, to prevent them bulging in the middle (due to the tamping down of the concrete).

There should be no cracks in the forms, or the concrete will ooze through and leave ribs on the wall, making the removal of forms difficult.

The inside faces of the moulds should be "greased" or "soft-soaped" before being put in position so as to render their removal easy from the face of the concrete. Moulds which consist of two wooden frames, as in the case of the short splash wall in the case of the dip, should be connected at intervals in the top by cleats.

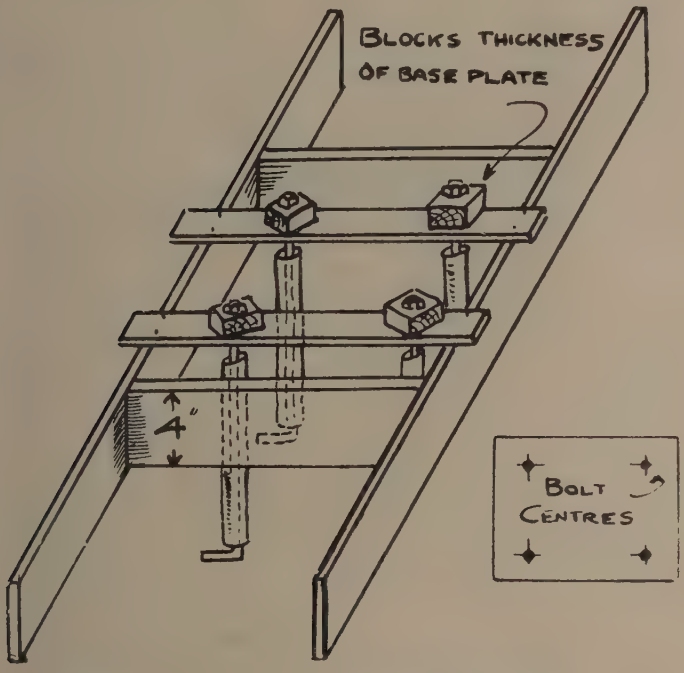
Reinforcing with Fencing Wire.

To strengthen a concrete building iron rods 5-16th inches or 3-18th inches in diameter are embedded in the walls. They are laid horizontally, and placed not more than 2 ft. apart. On small jobs, such as pighouses or sheds, old wire-netting or fencing wire could be used. The fencing-wire, being weaker than the iron rods, should be placed not more than nine or ten inches apart. The wire-netting should be cut into strips and doubled, so that the width of each strip is about two-thirds the thickness of the wall. These strips are laid flat and not more than nine or ten inches apart. The ends of all rods and fencing wire should be hooked.

Before undertaking concrete work, the farmer should be well equipped. A mixing-board on which to prepare the concrete is indispensable. A board 18 ft. by 9 ft. will give sufficient area to mix one cubic yard. This board can be made of hardwood flooring-boards, one inch thick and well cleated. For small quantities the ledge door of a stable could be used. A measuring box is also essential. A suitable size for this is 2 ft square and 2 ft. deep, giving a capacity of eight cubic feet. It has no bottom, and it should be strengthened with battens nailed on the outside, and be provided with double-ended handles. A watering-can with a fine rose is also needed. The quantity of water added to the mixture can be regulated with more certainty than when a hose is used, and there is no danger of washing out the cement. Square-mouthed shovels, a bucket to carry the concrete to the moulds, and a rammer made of 4 in. x 2 in. hardwood, three or four feet long are also required. Boards or moulds can be made of tongued and grooved flooring boards cleated together. Two feet is a suitable width for short moulds, but it will facilitate handling to make the longer moulds narrower.

CONCRETE FOR FOUNDATIONS FOR MACHINERY.

Engines, cream separators, Delco plants, pumps and other pieces of machinery require solid bases. These must be permanent and free from any vibration. A base constructed of concrete fulfils these requirements and is easily constructed. To form a base for the support of a small engine,



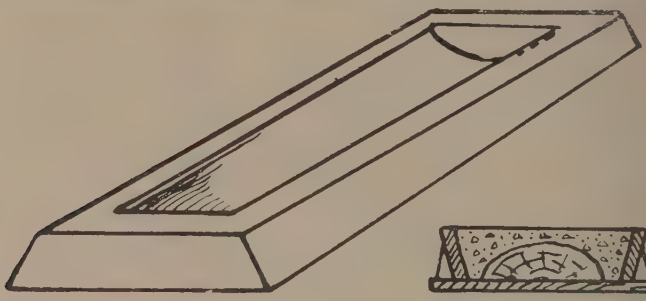
Wooden form for concrete foundation for machinery.

first excavate a pit two to three feet in depth (depending on the nature of the ground) and about a foot larger both in length and width than the dimensions of the engine base. Fix over this pit a wooden form to carry the concrete about 4 inches above the floor level. This form provides an easy means of locating the foundation bolts. Two strips of wood are nailed across the top of the form at the correct bolt centres and holes are drilled in same to accommodate the bolts. The bolts should extend into the concrete about a foot and should be bent over at right angles about 4 inches in length. Sufficient length of bolt should be left protruding from the concrete to allow for the thickness of the base plate and holding down nut. It is a good plan to enclose the bolts in gas pipe about twice the diameter of the bolt up to the concrete level. The open space formed around the bolt by the pipe allows for any slight errors in locating bolts or inequalities of castings. The pit and form can now be filled up with a concrete mixture containing 5 parts of stone, 2½ parts of sand and 1 part of cement. Keep the concrete wet for 24 hours after placing. After the en-

gine is adjusted on the base fill the spaces around the bolts with cement mortar mixed 1 part of cement to 1 part of sand. Do not start engine until the concrete has had sufficient time to harden up.

CONCRETE PIG TROUGH.

To construct a pig trough similar to the one shown below, make a box form the required size and place in the centre of it a half log as shown. The log should be about a foot shorter than the length of the box so as to allow about 6 inches of thickness at either end. A 4 : 2 : 1 mixture should be used, the largest size of stone being approximatey $\frac{3}{4}$in. in diameter. The



Concrete pig trough.

Box form with half log (end view).

trough is moulded upside down as shown and allowed to stand until the concrete has hardened up. In making concrete forms, much trouble can be avoided in removing the made article from the form by painting the interior of the form with common harvester oil before filling with concrete. As oil and grease will destroy green concrete, care must be taken to remove surplus oil before placing concrete.

CEMENT—SAND BUILDING BLOCKS.

The manufacture of Cement-Sand building blocks is a simple operation. Having a suitable block mould, certain proportions of sand and cement are mixed together with as little water as practicable and rammed well into the mould—the mould is then stripped from the block and the block set aside on a wooden or iron "pallet" to mature.

One of the most essential points to watch is that the sand used is clean and free from roots, clay and dust, etc., as these impurities stop the cement from setting properly.

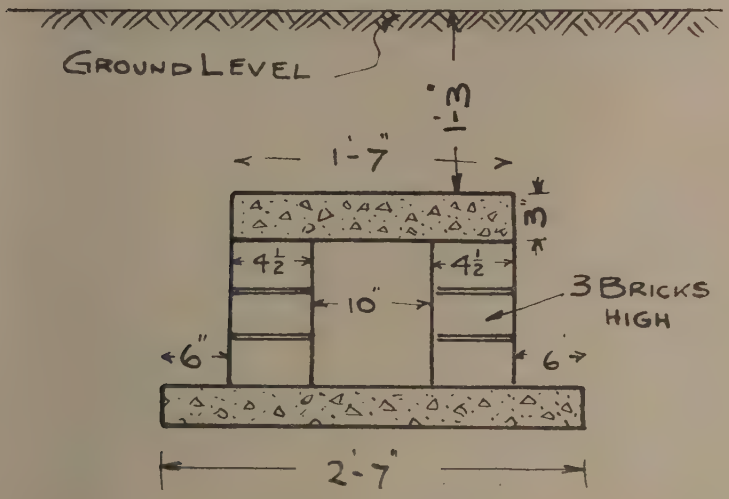
After the blocks have been made for a few hours, it is advisable to spray them with a fine spray of water so as to keep them damp—this spraying should continue at intervals for about a week, so that the blocks never get really dry—blocks so treated will show no tendency to crumble later on. Do not stack the blocks more than two or three high during the maturing period, otherwise the bottom row is apt to crack owing to weight being put on to the blocks before they have properly set. There are various types of block making machines and moulds on the market, ranging in price from about £3 to £50 or £60. For the average homebuilder one of the cheaper moulds is quite suitable, the more expensive types

generally being used or let out on hire by contractors. With these machines, of course, it is possible to turn out many more blocks per day than with the cheaper ones.

Various sizes of blocks are made, one of the cheaper moulds mentioned above makes blocks 18in. x 8in. x 6in. thick (with two cavities) for outside walls and 18in. x 8in. x 4in thick for inside walls.

The mixture of sand and cement advised for outside walls, is four parts of sand to one part of cement. One bag of cement will make about 22 blocks, using this mixture.

For inside walls, a mixture of five parts of sand to one part of cement can be used. One bag of cement will make about 30 such blocks. In calculating the number of bricks required it will be helpful to note that one block having a surface area of 18in. x 8in. equals 144 square inches, which equals one squae foot, thus a wall 10 feet by 12 feet in height would require 120 blocks, or one block for every square foot in the wall.



Small concrete culvert.

CULVERTS.

The question of conveying water under a roadway is a problem often met. The sketch above shows a useful sized culvert of inexpensive design. The concrete base should be taken to firm ground, no reinforcing bars are required in this slab. The top covering is made in slabs 18 inches long and put in position as soon as the brickwork is ready to receive it. These slabs should be reinforced with 3-8 inch diameter steel bars every 7 inches across and 3 bars placed longitudinally. The slab should be 4 to 5 inches thick. Care should be taken to consolidate the material on the outside walls after the slabs are put on, and if rammed hard to the level of the top of the slab, and then watered and left for a time, a further consolidation will take place, and the material can then be filled in to the ground level.

(To be continued.)

FERTILISER TRIALS AT SEAFORTH BOYS' HOME, GOSNELLS.

J. C. Palmer,
Dip. Agric., Potato Inspector.

This year a fertiliser trial was conducted in the Gosnells district. Through the courtesy of the Salvation Army authorities and Major Kemshall, suitable land was selected at the Seaforth Boys' Home. The standard "control" used in other portions of the State was again used against varying proportions of Nitrogen, Phosphoric Acid and Potash.

The land chosen for these trials was more or less typical of the soils to be found on river banks in the Armadale-Canning district. The soil varied from a red sandy loam to a heavier red loam, and had been under crops for some years and was rather infested with couch and other weeds.

Each fertiliser trial was conducted on a plot 2½ chains by 2ft. 6ins. wide and, consequently, each plot was 1/100 acre. Each trial was repeated six times and was so arranged that no two plots with the same manuring were adjacent to each other. The area chosen was divided up into six narrow lands to allow for adequate drainage, which unfortunately is too often neglected by growers in the winter plantings.

Certified Seed grown by Mr. F. Tonkin of Young's Siding was used, this having been selected from an 18-ton crop, and was cut into 2oz. sets. The cut sets were treated by the "Wet Bag" method. Planting took place on 4th July. The land was ploughed to a depth of about 7ins. and the sets were placed up the side of the furrow about 3in. from the bottom.

During the growing period, the plots were cultivated, hoed and ridged up. The first cultivation took place on 7th August. During the earlier portion of the growing period much dry weather was experienced, a factor which mitigated against a heavy crop. Later, the weather became somewhat unsettled and it was decided to spray with Schloesing's Prepared Bordeaux Mixture at the rate of 2lbs. per 15 gallons as a preventive of Irish Blight. The potatoes were well sprayed on 17th August. Finally the crop was dug in November, 4th-6th. During most of the growing period, the weather on the whole was on the dry side. The ground itself which sloped towards the river became very dry and powdery and did not appear to hold moisture too well. There was a crop growing in the land surrounding the trials. Exactly the same seed was used and was planted more or less about the same period. These potatoes, however, yielded much less than those on the experimental area. This may have been due to the fact that these other potatoes were neither sprayed nor side-dressed.

In these trials, the nitrogen was applied in two dressings, one half at the time of planting in the furrow and the other half as a side-dressing. The side-dressing was given when the plants were showing well in the rows. The reason for this method of applying the manure was that it was suspected that there might be a leaching out of the sulphate of ammonia in the drainage water of the soil. Sulphate of ammonia is readily soluble in water, and if there should be excessive rain much of it would be lost to the young plants. A comparative trial of this method against the custom of applying all the sulphate of ammonia in the furrow, was not made in this particular experiment. The crop grown round the trials was planted with exactly the same type of seed as that of the Departmental trials, but all the sulphate of ammonia was applied in the furrow. There was relatively a much higher yield in the Departmental trials than was obtained from the crop growing round it. Shortly before the side-dressing

was applied (a matter of 35 days after the planting of the crop) the young plants were showing well in the rows, but they were also showing the effect of too much dry weather. Rain fell freely after the application of the side-dressing. This gave the crop a filip and gave it such a start that it was standing up well when the potatoes all round the trials had "gone down." After the side-dressing, it was quite an easy matter to pick up by inspection the plots which had received no nitrogen in their manure. In the non-nitrogen rows, the plants were rather stunted and the leaves were yellowish.

Nitrogen Series.

Interesting results were obtained in the nitrogen series of these trials. Two variations of nitrogen, with the other constituents of the mixture remaining constant, were tested against the standard "Control" mixture. In all three mixtures there was 1,430 lbs. super and 210 lbs. sulphate of potash. The details of the quantities of nitrogen are shown in the table below:—

Sulphate of Ammonia per acre in lbs.	Lbs. of Nitrogen per acre.	Percentage of Nitrogen.
250	50	3
*500	100	6
0	0	0

* Control.

As the amount of nitrogen was increased from 0-100 lbs. per acre so the crop increased from 67 lbs. per plot (2 tons 19 cwts. 3 qrs. 8 lbs.) to 148 lbs. (6 tons 12 cwts. 0 qrs. 16 lbs.). The table below shows these figures.

Lbs. of Nitrogen per acre.	Yield in lbs. per Plot.	Yield in tons per acre.				Percentage Yield.
		T.	C.	Q.	lbs.	
50	116	5	3	2	8	78
*100	148	6	12	0	16	100
0	67	2	19	3	8	45

* Control.

A more detailed study of these figures shows a steady increase of crop as the quantity of sulphate of ammonia is increased. Further, that by applying approximately 5 cwt. of sulphate of ammonia per acre in two dressings, part at planting time and part as a side-dressing, an increased yield of 72 cwt. of potatoes was obtained over the crop grown without a nitrogenous fertiliser.

Phosphoric Acid Series.

The varying ratios of manure are indicated below, the fixed proportions were 50 lbs. sulphate of ammonia and 210 lbs. sulphate of potash.

Super. per acre in lbs.	Lbs. of Phosphoric Acid per acre.	Percentage of Phosphoric Acid.
1,668	350	15
*1,430	300	14
1,907	400	16

* Control.

In the table given below, it will be seen that by increasing the superphosphate from 1,430 lbs. per acre (300 lbs. phosphoric acid) to 1,668 lbs. (350 lbs. phosphoric acid), an increase of 13 cwt. per acre was obtained. When, however, the superphosphate was increased to 1,907 lbs. (400 lbs phosphoric acid), there was found a diminished yield compared with that of the 1,668 lbs. application.

Lbs. of Phosphoric Acid per acre.	Yield in lbs. per Plot.	Yield in tons per acre.				Percentage Yield.
		T.	C.	Q.	lbs.	
350	145	6	9	1	26	112
*300	130	5	16	0	8	100
400	138	6	2	1	8	106

*Control.

Weighing up the yields from the plots.

The inference in this case is that an increase of superphosphate from 1,430 lbs. to 1,668 lbs. per acre is probably beneficial, but that 1,668 is probably the greatest amount of superphosphate which will give an increased yield on this type of soil. In this case, the application of an extra 2 cwt. over the quantity used in the "control" mixture of superphosphate in the mixture gave an increase of 13 cwt. of potatoes.

Potash Series.

The potash series did not show any outstanding results. As in the other trials, two variations of potash manures were used against the standard "control." These variations are tabulated below; the superphosphate and the sulphate of ammonia remained constant:—

Sulphate of Potash per acre in lbs.	Lbs. of Potash per acre.	Percentage Potash.
415	200	8
*210	100	5
0	0	0

* Control.

The table shown below would seem to indicate that no material benefit was derived by increasing the amount of potash from 0 lbs. per acre to 415 lbs., in this type of soil.

Lbs. of Potash per acre.	Yield in lbs. per Plot.	Yield in tons per acre.				Percentage Yield.
		T.	C.	Q.	lbs.	
200	136	6	1	1	20	98
*100	138	6	3	0	26	100
0	138	6	3	0	26	100

* Control.

From these results one would infer either that there was enough potash in the soil without any further addition, or else that in the earlier part of the season, which was very dry, little, if any, of the added potash was dissolved by the soil waters. In the latter case the potash manure added to the soil was not used at all by the crop.

Due to a short supply of Mr. Fred. Tonkin's seed, the seed used to plant the "buffer" rows was the progeny of his seed, which had been grown twice in the South-Western area, first in the winter crop and then in the summer planting. For the whole of the period during which these potatoes were grown in the South-West, they were under inspection by this Department. Further, for each planting the seed was selected carefully at the previous digging. This was to maintain, if possible, both the quality and the vigour of the seed. Thus these potatoes were of known strain and they had been looked after carefully during the time of growth in the South-West area. These potatoes were examined at the time of cutting and "Wet Bag" treatment, and appeared to be of a good type and of an excellent size and quality, though possibly not quite so forward in their sprouting as that seed obtained directly from the South. In both cases, however, the seed came directly or indirectly from the South and from the same grower in the South. In other words, both types of seed were from the same strain and both were treated in the same way. The only difference was that the seed used in the buffer rows had been grown twice in the South-Western districts.

It has been suspected that potatoes grown in the warmer potato regions are apt to become infected with mosaic and other virus diseases. For some while growers have found that there is a tendency for strains brought in from the Southern districts "to run out" and to yield less after cropping for some seasons in the South-Western areas. With this decrease in yield has been associated the growth of plants of dwarf growth and abnormal leaves. In other words, there is a certain amount of virus infection which must have been acquired, for the crops grown in the Southern area do not appear to suffer in this way to any extent. So that some idea of the amount of possible infection that might occur, the plants in the buffer rows were kept under observation.

Visible mosaic infection (that is to say, dwarfed plants with abnormal leaves) was noticed in the early stages of their growth. At a later count there was about 33 per cent. of visible mosaic infection, or one plant in four was infected with virus troubles. There is a probability that much more mosaic, more or less marked, was present. This was in marked contrast with the plants growing from seed brought directly from the Southern area, which showed little, if any, trace of visible mosaic infection.

A direct consequence of heavy virus infection is decreased yield. Thus from a consideration of the yield alone, without any reference to visible mosaic infection, these rows were in all probability heavily infected with virus trouble.

The potatoes grown from seed "twice" grown in the South-West were therefore much more affected with this trouble than those grown from seed directly obtained from the Southern area. The inference must be that during its period of growth in the South-Western areas the trouble must have been largely increased. This would seem to suggest that it is a wise policy for growers in the South-Western districts to bring their seed annually or at least biennially from Southern areas. In order to have the best possible seed, it would be better if seed were obtained from crops certified by the Department under the Seed Certification Scheme.

SUMMARY.

1. There seemed to be a general indication that when sulphate of ammonia is added in a manurial mixture, it is a good practice to apply some of the sulphate of ammonia in the furrow and the rest as a side-dressing, at least, in July and August planting.

2. In these trials is was found that 500 lbs. of sulphate of ammonia per acre gave an increased yield of crop more than proportionate to the cost of the manure.

3. There were indications that the application of superphosphate can be increased to 1,668 lbs. (approximately 16 cwt.) per acre.

4. The general "Control Mixture" used in all the Departmental Trials was found to be a very successful mixture in this type of soil. This mixture consists of approximately 14 parts of superphosphate, 5 parts of sulphate of ammonia and 2 parts of sulphate of potash, and is applied at the rate of 1 ton per acre.

5. Growers in the South-Western areas would be well advised to bring their seed from certified strains grown in the Southern areas biennially, or, better still, every year.

THE FARMERS' HANDBOOK.

A REVIEW. (Editor.)

We have received a copy of "The Farmers' Handbook," New South Wales, Fifth Edition, issued by direction of the Hon. H. V. C. Thornby, M.L.A., Minister for Agriculture, a publication which could profitably find a place in every farmer's library.

Primarily the work deals with the farm land districts of the parent State, and gives a succinct review of each division of territory concerned, as regards its topography, geology, soil classification and climate. Native timbers and their utility for various purposes is featured, while the cost of clearing the land and preparing for cultivation the areas described is detailed to the reader. This section also supplies information as to water ways, meteorological statistics, and agricultural, horticultural and pastoral production and potentialities, whilst the most up-to-date crop and rainfall map so far compiled is included in its pages.

There is found also a valuable treatise on the chemistry of the soil, embracing factors which determine fertility and causes of infertility, stressing the chemical composition of plant life and manurial values. These have of necessity particular application to the State of New South Wales, but embody much information concerning which no farmer can afford to remain ignorant.

Wheat culture; sheep on the farm; cereals; legumes and root crops; vegetable and miscellaneous crops, the last-mentioned including broom millet, sugarcane, Indian cane, Sudan grass, rape, kale and linseed, are all dealt with in an informative way.

Grasses and pastures will appeal to the pastoralist, but the subjects of particular value to the farmer of this State are to be found in silos and silage; the feeding of farm stock, including vitamines; feeding in relation to disease, and analyses of fodders.

A section devoted to "The Handy Man on the Farm" discusses harness; harness fitting and repairing; the use and care of rope; blacksmithing for farmers; tank making; carpentry; and painting on the farm, and provides interesting instruction which should reward any husbandman who secures a copy of this valuable publication.

Farm measurements and useful tables contrive to elucidate farmers' problems in relation to the measuring up of paddocks, stack building, dam sinking, and like employment, while instruction in book-keeping is imparted simply and effectively, and will be found not only of great interest, but of assistance in setting up and keeping a concise and correct record of profitable and unprofitable lines, detecting waste and leakage, and repairing errors in connection with financial undertakings.

The book generally forms a concretion of useful information such as men on the land require, and is necessarily of plural authorship, each having striven to vision the farmers' difficulties and interpret his needs with the object of distributing easily assimilated advice. In expression each has aimed at simplicity in the delivery of thought.

A number of the subjects with which it deals have from time to time been discussed in our own columns, but in a general sense the Farmers' Handbook collates all information, with a ready and excellent reference. It is issued by the Department of Agriculture, New South Wales, printed in clear type on good paper, is profusely illustrated, and may be obtained for the sum of 11s. 4d. per copy, which includes postage to any place within the Commonwealth.

"EARLY BLIGHT" OR "LEAF SPOT" AND THE MACROSPORIUM "STORAGE DISEASE" OF POTATOES.*

Caused by *Macrosporium solani* (Ellis and Martin), more commonly known as *Alternaria solani* (E. and M.) Jones and Grout.†

H. A. Pittman, B.Sc., Agr.,
Plant Pathologist.

The disease known variously as "Early Blight," "Black Spot," "Leaf Spot," "Target Spot," "Macrosporium Leaf Spot" or "Alternaria Leaf Spot" is found all over the world wherever potatoes are grown. It has been present for many years in Western Australia, but its depredations have never been taken very seriously, owing to the fact that it usually only occurs in epidemic form shortly before the tubers are harvested—and in consequence has never been considered capable of causing any great amount of loss. As will be seen later, however, its potentialities for destruction have, in the past, been grossly underestimated, and it behoves all growers in Western Australia from now on to regard this disease as one of the worst troubles with which they will have to contend. Particularly is this so in the case of growers of Certified Seed, on account of the serious deterioration which the fungus is capable of causing in the tubers after digging.

SYMPTOMS AND EFFECTS ON THE PLANTS.

In the field the disease may attack leaves, petioles or stems. (Fig. 1.) It is, however, most commonly found on the leaves, where it causes circular or irregular, dark-brown to almost black, dead areas, which often, on close examination, reveal a peculiar and characteristic zonation strongly suggesting a crude target or the contour lines on a map (see Fig. 3). The first spots commonly develop on the lower leaves. Under favourable circumstances each of the individual lesions may enlarge very rapidly, so as eventually to involve a very considerable portion of a leaflet, and when this is the case little or no zonation may be seen, as the zonation is an indication that the growth of the fungus has been relatively slow and spasmodic rather than swift and continuous. Lesions may coalesce where they meet, and in this way very extensive dead brown areas may be formed. Frequently, however, a large number of small, more or less concentrically-zoned areas will be found on each affected leaf. (Fig. 2.) Infection of a leaflet often takes place near the edge, and the dead area may then progress inwards in a wedge-like manner between several of the larger veins until the mid-rib of the leaf is reached. Infected leaves soon lose their normal green colour and become a pale green, or sickly yellow, between the diseased areas. The margins and tips of the leaves tend to roll upwards

* For information re "Rhizoctonia Scab," "Common Scab," and "Irish Blight," see the two preceding issues of this Journal, or reprints of same issued as Departmental Leaflets.

† As is a matter of common knowledge, there has been much argument and confusion in the literature as to the correct name for the fungus causing "Early Blight" of potato foliage. In the absence of any authoritative ruling on the matter, such as could be given by an International Conference of Mycologists, the original name is here being used.

towards the midribs, and the infected parts of the leaf may soon become so dry and brittle that they readily crack and crumble up if the leaf is vigorously blown about by the wind, handled, or knocked in passing. Breaks in the diseased tissue frequently occur in this way, and large areas of diseased tissue may fall out, giving the affected leaves a badly shot-holed appearance. (Fig. 3.) The stalks of diseased plants sometimes show dead brown areas due to attack by the *Macrosporium* and in such cases if the water supply to the top of the plant is thereby cut off, marked wilting and drying up of the plant above the directly-injured portion may result. Under conditions very favourable to the disease the plants may be destroyed as rapidly, and as completely, as by an epidemic of Irish Blight (9). Thus in the warm, moist, conditions of Bermuda the loss has been so rapid, and the lesions so large and indefinitely outlined, that considerable difficulty has at times been experienced in determining that the disease was due to *Macrosporium* without detailed laboratory examination. Under most circumstances in Western Australia, however, the disease does not reach its height until the vigour of the tops is starting to decline towards the end of the growing season. Nevertheless plants whose vigour has been prematurely reduced by the agency of some other parasite, or by some incompatibility between the plants and their inanimate environment, may be seriously attacked when the majority are but little affected. As the designation "Early Blight," has, however, in Western Australia, little aptness under most circumstances, it is proposed to refer to the disease hereafter as "Macrosporium Blight."

Loss of leaf tissue in the manner depicted above has a marked influence on the size and number of the tubers formed by the plants, as the leaf surface represents the factory space in which starches and other substances which go to fill up the tubers are formed. Hence any reduction in leaf surface means, at least, a concomitant reduction in yield. This is a point which might well be borne in mind by growers when endeavouring to belittle the damage done by the disease as an argument against preventive spraying.

HOST PLANTS.

Macrosporium solani is capable of attacking many other plants beside the potato. The only ones of interest to the potato growers of Western Australia are, however, the tomato, egg plant and common nightshade (*Solanum nigrum*). As shown by Folsom and Bonde (3, 4) and more latterly by Bonde (2), numerous, more or less indefinite, strains occur, some of which are much more virulent than others. Some of these strains attack foliage rather than tubers, some tubers rather than foliage, and some attack either indiscriminately.

LIFE HISTORY.

The life history of the fungus is very simple. Unlike many parasitic fungi only one type of spore (seed-body) is produced. These spores are very characteristic, being brownish in colour, blunt-nosed, long-tailed, and divided up into a number of separate cells by many transverse and occasional longitudinal walls (see Figs. 3 and 4). Most of the individual cells are capable under favourable circumstances of giving rise to an *infection thread* or *germ-tube*, so that the host has little chance of escaping infection if a spore happens to be blown or splashed onto a leaf or other plant part. (Fig. 4.) Under favourable conditions fairly large numbers of spores are

produced on the dead areas of the leaves. The spores are able to germinate, under ordinary weather conditions, as soon as they come in contact with moisture. (Fig. 4.) Infection may take place through the breathing-pores (*stomata*) on the leaves, or directly through the epidermal walls or insect injuries. New spots on the leaves, etc., may develop within 48-72 hours of inoculation, while spore production usually occurs within 3-4 days.

The source of the fungus-material (*inoculum*) for the first infections of the season is supposed to be overwintered spores,—new spores from fungus threads overwintering in potato remains in the soil, or from infected tubers.

In artificial culture the fungus frequently shows little inclination to spore, unless the medium is lacerated and allowed to dry out gradually in the sunlight (8), but in nature the production of spores appears to offer little difficulty. According to Rands (7), optimum spore production in the field is dependent on frequent rains, aided by heavy dews. High temperatures unfavourable to the potato plant, combined with sufficient moisture to ensure maximum spore formation, cause the disease to spread most rapidly —whereas droughty periods check its spread and seriousness. *Epidemics are likely to occur if high temperatures are associated with frequent moist periods and the plants are in a somewhat weakened condition.* For this reason "Macrosporium Blight" is most frequently found here in serious form after the commencement of the early autumn rains, towards the end of the growing period of the "summer" crops grown on the drained swamps such as at Benger. These crops are normally but little attacked prior to the commencement of the autumn rains, on account of the high temperatures and low humidity of the atmosphere during the preceding part of the growing period.

STRAINS OF MACROSPORIUM SOLANI.

Folsom and Bonde (3, 4) and more recently Bonde (2) working in Florida and Maine, U.S.A., have shown that the fungus, as isolated from potato tubers, consists of a number of more or less ill-defined strains, varying in spore dimensions, appearance of the colonies, abundance of spore production, frequency of mutations, rapidity of growth, stability of type, pathogenicity on leaves and tubers, and pigmentation of the potato-dextrose-agar medium. Some strains attack leaves mostly, others chiefly tubers, while still others appear able to attack either with equal readiness. The same variation in the species as indicated by chromogenicity, appearance, stability of type, rapidity of growth and pathogenicity on tubers has been observed in the present preliminary investigations. No tests have been made as to pathogenicity on leaves.*

MACROSPORIUM SOLANI AS A CAUSE OF TUBER-ROTTING.

For very many years after it had been demonstrated that *Macrosporium solani* was the cause of the "Early Blight" disease of the foliage, it was the common belief, and was emphatically stated in the text-books that the

* The present investigations are not by any means complete; nevertheless it has seemed desirable at this stage to acquaint the growers with the cause of the very troublesome "Storage Disease" and its most salient characteristics, so that they may be in a position to take steps to combat the trouble during the forthcoming "Summer" crop. Full experimental details will be published later.—H.A.P.

fungus could not attack potato tubers. In 1925, however, Folsom and Bonde (3, 4) proved conclusively that *Macrosporium solani* was the cause of a rather serious tuber-rot in the State of Maine, U.S.A., and especially in tubers, quite healthy when dug, on being opened up by the purchasers after railway transport from Maine to Florida. They showed that infection could take place through lenticels, wounds or eyes. The symptoms as described on Spaulding Rose tubers by them were as follows:—

> "The spots or lesions usually are darker than the healthy skin and appear somewhat sunken, sometimes surrounded by a slightly raised border. Their outline may be circular or irregular. The lesions are nearly always shallow and small, rarely exceeding a centimetre in diameter, and the transition from diseased to healthy cortical tissue often is abrupt enough that it is easy to lift out the infected portions intact. Apparently the invasion of new tissue by the parasite often ceases, and is slow when it continues after the first stage . . . . . *In the late summer of* 1924, *diseased Irish Cobbler foliage and somewhat immature Spaulding Rose tubers were packed together at various times. Usually abundant lesions resulted. When controls consisted of tubers not packed in the leaves no infection occurred.** Sometimes such a control was divided after infection had occurred in the corresponding inoculated tubers, and part of the control was inoculated in the same way, with similar positive results. *When well-sprayed, comparatively healthy foliage was packed with the tubers, only a few lesions appeared.* All platings from lesions soon after their appearance yielded pure cultures of *Alternaria solani*. These results suggest the possibility of infection of freshly-dug tubers from contact with diseased foliage. In Maine, digging is necessarily often done before the vines are all dead, or within a few days after the vines have been killed, wholly or in part, by low temperature. The death of the vines in the former case may be hastened by early blight. *Therefore diseased foliage often comes into contact with freshly-dug, somewhat immature tubers, which are more or less bruised by the time they are put into storage.*"

The latter part of the above extract is particularly interesting, in as much as there is obviously a striking parallel between the conditions under which the potatoes are often dug in Maine and in Western Australia. With us, the sudden onset of the heavy autumn or winter rains after the dry weather of the preceding part of the growing period of the "summer" crop, planted about January, frequently necessitates the tubers being dug very hurriedly and therefore somewhat immature. This is owing to the danger of rapid flooding of the rich swamp lands which are every winter and spring under water. With the onset of the rainy season there is frequently a heavy infestation of the foliage with "Early Blight," and by the time the majority of the crops are harvested conditions are such that the more or less immature, skin-rubbed tubers frequently undergo a veritable "baptism of spores." Consequently it would be rather remarkable, in view of the work of Folsom and Bonde (3, 4), if a certain amount of tuber-rotting was not experienced here during the winter in our stored potatoes, provided always that the variety grown ("Delaware") were susceptible.

As a matter of fact, a very serious deterioration in potatoes harvested in the autumn, and stored in open storage during the winter months of

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* The italics throughout this quotation are mine.—H.A.P.

the year, has been taking place here for many years and has long been known by the growers as "Storage Disease." In some seasons as many as 30 per cent. of the tubers in open storage have been affected. The cause of the disease has never been determined, and potato growers and agents have resigned themselves more or less philosophically to what they have regarded as an inevitable but variable source of loss. (See Figs. 5-11.)

Shortly after the appointment of the writer to the position of Plant Pathologist in March of the present year, the disease became so serious, especially in connection with certain lots of Certified Seed, that it was felt that a determined effort would have to be made to ascertain the cause of the trouble. Consequently when the active work on the Bitter Pit investigations, which are being carried out in co-operation with the Council for Scientific and Industrial Research, slackened off for the year, an attempt was made to isolate possible pathogens. A large number of isolations were made with the result that the peculiar agar-yellowing and -reddening mycelium of *Macrosporium solani* was readily obtained. In addition, *Fusarium* (?) *oxysporum* and several species of bacteria were obtained from a few of the isolations. In no single case, however, was the *Macrosporium* not obtained, and in every case where an isolation was made from the edge of a lesion only the *Macrosporium* resulted—the *Fusarium* and bacteria only being obtained from the older, secondarily-infected parts of the lesions.

For some time following the isolations the identity of the *Macrosporium* could not be determined definitely, owing to its disinclination to fruit, but on partial drying-out the petri-dish cultures fruited rather abundantly in places, especially where the agar had been disturbed, or on the old piece of agar used to transfer the culture onto a new plate. Subsequently spores have been abundantly obtained in petri-dish culture after the agar has been lacerated, and the cultures allowed to partially dry out in the sunlight as recommended by Rands (8). As in the work of Folsom and Bonde (3, 4) and Bonde (2) chromogenic, non-chromogenic and variably-chromogenic strains were isolated. Inoculation and re-isolation experiments both with spores and mycelium have demonstrated that *Macrosporium solani* is the cause of the disease.

Mr. G. Samuel, Plant Pathologist to the Waite Agricultural Research Institute, Adelaide, South Australia, to whom a specimen of diseased tuber had been submitted, and to whom I am greatly indebted for much assistance in providing literature, etc., unavailable in Western Australia, replied as follows:—" . . . . I was interested to find on making cultures that the fungus present was *Macrosporium solani*." Subsequently Mr. D. B. Adam, Plant Pathologist, Department of Agriculture, Victoria, in correspondence with this Department re "Storage Disease" advised, "It happens that this year we had our attention drawn to a similar, if not identical, spotting of potatoes in this State. Indeed the matter was under investigation at the time of the receipt of your letter. At present, as the result of cultural studies and inoculation tests, I am confident that the spotting in the tubers submitted is due to the same fungus, viz., *Alternaria solani*, as is responsible for the Early Blight disease of the foliage. Actually, in some districts, last year was a bad year for this disease in the foliage of our crops and it was the first year in which there was an appreciable number of these black, sunken marks on the surface of potato tubers."

VARIETIES ATTACKED.

The American writers (3-6) have so far found the disease on Spaulding Rose, Early Rose, Irish Cobbler, Green Mountain, Bliss Triumph and Smooth Rural. In Western Australia it has only been found on two varieties, viz.: "Manistee" imported from Victoria, and "Delaware," which is the only variety grown locally on a large commercial scale. At this point it may be of interest to readers in other States or countries to remark that, unlike most potato-growing countries, only one variety has been cultivated here at all largely. This is a large, white-skinned and white-fleshed, quick-growing, early-maturing variety apparently identical with, or a strain of the American "Delaware" as described in U.S.A. Department of Agriculture Bulletin No. 176, "Group Classification and Varietal Descriptions of some American Potatoes," by W. Stuart, published in 1915. The general shape is variable, short and round, or quite as frequently with us long and rather much flattened, according to the district and soil conditions under which it is grown. It takes about three months from date of emergence to mature a crop in the summer time and about four months when grown in the winter. The white skin has a very marked tendency to rub off, exposing the flesh of the tuber, if dug, as is frequently the case, somewhat immature.

DESCRIPTION OF THE MACROSPORIUM SOLANI STORAGE DISEASE ON THE TUBERS.

Unlike the relatively small lesions found by Folsom and Bonde (3, 4), Gratz (5), and Gratz and Bonde (6) on American tubers, the lesions of the "Delaware" in Western Australia are for the most part externally very large. (Figs. 5, 6, 7, and 10.) The American writers appear to have recorded no lesions larger than about 2 cms. in diameter. With us, however, it is not at all infrequent to find one quarter to one third of the area of both sides of a tuber affected in a single lesion. (Figs. 6 and 9.) As the "Delaware" tubers when grown on our rich, peaty, drained-swamp lands are not infrequently nine inches or so in length by about four inches or more in width, the size of many of the lesions can be readily imagined. Smaller lesions, of course, also occur, and when infected tubers are carefully examined it is generally found that the larger lesions have originated at a place where a very considerable area of skin had previously been rubbed away, while the smaller lesions are usually the result of *lenticel* (breathing-pore) infections. The lesions are in all cases sharply depressed—darker in colour than the healthy skin, often quite glossy, and sharply marked off from the neighbouring healthy tissues. They may or may not be surrounded by a raised margin. Frequently the lesions have a gun-metal-like sheen, but sometimes they are of a dull brown or blackish hue. Very large lesions may be interrupted, here and there, by ridges, promontories, or islands of healthy tissue. (Fig. 6.) The lesions are quite unlike those caused by any other disease present in Western Australia. They are usually more or less circular where they have originated as a result of lenticel infections, but where the parasite has gained entrance to the tuber as a result of the rubbing-away of skin during harvesting, the lesions may be very irregular and are of no constant or characteristic shape. The fungus induces a comparatively slow, progressive dry-rot of a very characteristic type. Thus on cutting, very dry, brown or blackish areas will be found in the flesh immediately below the surface depressions. In proportion to the depth of the surface depressions and the surface area

of the lesions, the internal depth of discoloured tissue is often surprisingly small (see Fig. 10) and it is usually fairly sharply marked off from the adjoining healthy flesh. In the majority of the tubers so far examined the dead tissue of the flesh has varied from one-eighth to one-half an inch in depth. Observation and inoculation experiments still in progress indicate that the fungus attacks the flesh with most rapidity shortly after the commencement of infection, and thereafter, as the age and maturity of the tubers increases up to a point, the rate of attack gradually falls off. Thus tubers taken out of open storage badly infected, five to seven weeks after being dug immature, have been subsequently kept under observation at room temperature for many weeks without the lesions becoming very much larger, except where secondary infection with *Fusarium spp.* or bacteria has occurred.

In the later stages of the disease, however, secondary infection by bacteria and *Fusarium oxysporum* is common (Fig. 11), and in this case more or less complete destruction of the still healthy flesh speedily ensues. As no tubers have ever been found infected with "Storage Disease" at digging time, either here or elsewhere, infection presumably takes place during digging, from the spores produced on the "Macrosporium Blight" lesions on the leaves.

SUMMARY OF SALIENT FEATURES REGARDING THE MACROSPORIUM STORAGE DISEASE.

As a result of the experience of Potato Inspectors of this Department during a considerable period of years, and of infection experiments already carried out and still in process of being carried out by the writer, together with the findings of the American workers, the following statements may be made with a considerable degree of assurance as to their correctness.

1. **Serious loss in stored potatoes from the Macrosporium solani Storage Disease is likely to follow an epidemic of "Macrosporium Blight" on the foliage late in the season shortly before the "summer" crop tubers are dug.**

2. **Infection of the tubers takes place during digging time from the spores produced on the "Macrosporium Blight" lesions on the leaves.**

3. **The Storage Disease is to all intents and purposes a disease of tubers dug in an immature condition. Potatoes dug when properly matured and after the skins are properly hardened are either not attacked, or if attacked only develop small, unimportant lesions.**

4. The fungus is able to enter the tissues either through lenticels (breathing pores), eyes, or through places where the skin has been rubbed away during the digging and bagging operations. The latter condition is by far the most important, and accounts for the relatively enormous lesions commonly found here after only a few weeks in open storage.

5. Storage Disease works much more rapidly at relatively low temperatures than at high temperatures. In the experiments so far carried out here very serious lesions rapidly developed at room temperatures, 50-60 degrees F., but in the incubator at a temperature of 77 degrees F., very little, if any, infection or subsequent development took place.

American experiments showed that, with the varieties worked upon, infection and increase in the size of the lesions took place most rapidly at temperatures between 55 degrees and 60 degrees F., but no infection occurred below 41 degrees F. or above 77 degrees F. (6).

CONTROL OF "EARLY BLIGHT" AND "STORAGE DISEASE."

From what has already been said it appears that the following control methods will have to be taken by growers desirous of avoiding reduction in yield and subsequent deterioration of the tubers in storage. Especially is it important that the growers of Certified Seed do all they possibly can to prevent the development of "Storage Disease," since this defect can not be lightly regarded in connection with such seed.

1. **Preventive spraying of the foliage with Bordeaux mixture 4-4-50, or dusting with a recognised copper carbonate-sulphur dust should be carried out as a routine practice.** As is the case with Irish Blight," "Macrosporium Blight" can be readily prevented by spraying with Bordeaux mixture. The mixture should be applied with considerable force to both sides of the leaves, and every care should be taken to thoroughly spray the lower leaves as these are frequently the first attacked. If the commercial powder is used, mix one pound to six gallons of water. Past experience indicates that in most districts one thorough spraying (or dusting) towards the end of the season may be sufficient to prevent the epidemic which so often occurs prior to digging time. More frequent treatment may, however, be required if the weather conditions of the season are unusually favourable to the occurrence of the disease on the leaves. It is realised that the average grower may not take kindly to the idea of spraying his potato fields as a preventive measure against "Macrosporium Blight," owing to the fact that the great rarity of epidemics of "Irish Blight" here has never forced the grower to adopt routine spraying with fungicides. Nevertheless a condition of affairs now exists where either spraying or the use of appropriate copper carbonate-sulphur dusts will have to be resorted to as the only satisfactory way out of the difficulty. **If the disease is prevented from appearing on the foliage no infection of the tubers can result as there is no other source of spores. Spraying is more effective than dusting.**

2. If possible, **the tubers should never be dug until the tops have died down naturally and the potatoes have properly matured in the ground, as Storage Disease is essentially a disease of tubers dug immature.**

3. If the tubers must, of necessity, be dug immature, on account of the danger of flooding of the land before they could otherwise be harvested, or for any other reason, and the tops are badly affected with "Macrosporium Blight," every attempt should be made to first spray the foliage and soil with Bordeaux mixture to destroy as many of the spores as possible.

4. If it is not possible to spray with Bordeaux mixture before digging when the tops are badly affected with "Macrosporium Blight," and the tubers must be dug immature on account of the danger of flooding, etc., every attempt should be made to have the tubers sold and consumed within as short a period after harvesting as possible.

5. **Every possible care should be taken during the digging and bagging of the tubers to cause as little skin-rubbing as possible, as the most serious lesions invariably develop at places where the skin has been rubbed away during these operations.**

6. **Leaves and stems of potato plants should never on any account be placed in the tops of the potato bags owing to the great danger of copiously inoculating the freshly-dug tubers with the spores of the Macrosporium.**

7. Tubers should be stored, if possible, below 41 degrees F. so as to inhibit the development of the disease.

8. Potatoes affected with "Storage Disease" should not be used for seed purposes unless sufficient others cannot be obtained. In this case the diseased parts should be carefully cut away, as it is quite likely that such infected tubers afford one of the most important means of disseminating the disease from season to season, although such has not yet been experimentally demonstrated.

9. The plants should be kept well hilled-up so as to obviate the possibility of any spores being washed or blown onto the tubers through cracks in the soil before digging.

10. Wider planting than is at present in vogue should be resorted to, so as to facilitate the necessary cultivation, spraying or dusting operations.

11. Rotation of crops and burning of the diseased plant remains should be carried out, whenever possible, so as to lessen the sources of infection for succeeding crops.

12. It may eventually be found possible to prevent the disease in Certified Seed, without injury to the tubers, by dipping, immediately after digging, in certain strengths of formalin, mercuric chloride, etc., but the possibilities in that direction have not yet been investigated.

13. Never bag the tubers, if it can be avoided, in a wet condition.

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2. Bonde, Reiner. "Physiological strains of *Alternaria solani*." Phytopath, 19; pp. 533-548, 1929.

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6. Gratz, L. O., and Bonde, R. "Infection of potato tubers by *Alternaria solani* in relation to storage conditions." Florida Agr. Expt. Sta. Bull. 187, 1927, in Fla. Agri. Expt. Sta. Ann. Rept., 1927; pp. 167-182, 1927.

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9. Whetzel, H. H. "The Alternaria blight of potatoes in Bermuda." Phytopath, 13; pp. 100-103, 1923.

Fig. 1.—"Early Blight" or "Macrosporium Blight," due to *Macrosporium solani*, on potato foliage. *After Chupp (slightly modified).*

Fig. 2.—Various stages of "Macrosporium Blight" ("Early Blight") on potato foliage. *Photo by author.*

Fig. 3.—A. "Macrosporium Blight" ("Early Blight") on potato leaf showing characteristic zonation of the lesions. *After Kirk (modified).*
B. Leaflet showing zonation of the lesions .
C. Spore of *Macrosporium solani.*

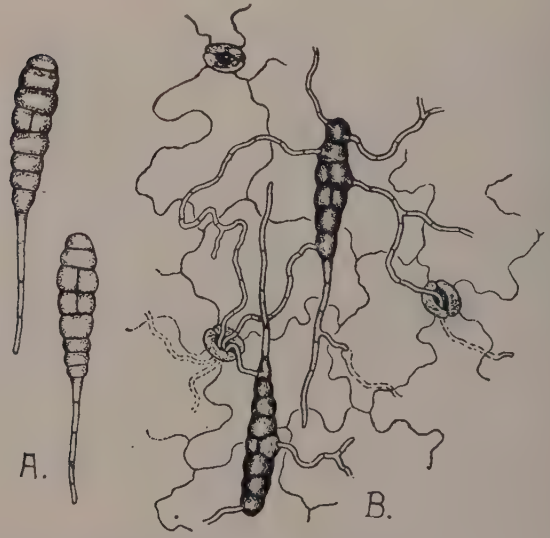


Fig. 4.—A. Spores of *Macrosporium solani.*
B. Spores of *Macrosporium solani* germinating on potato leaf. *After Jones.*

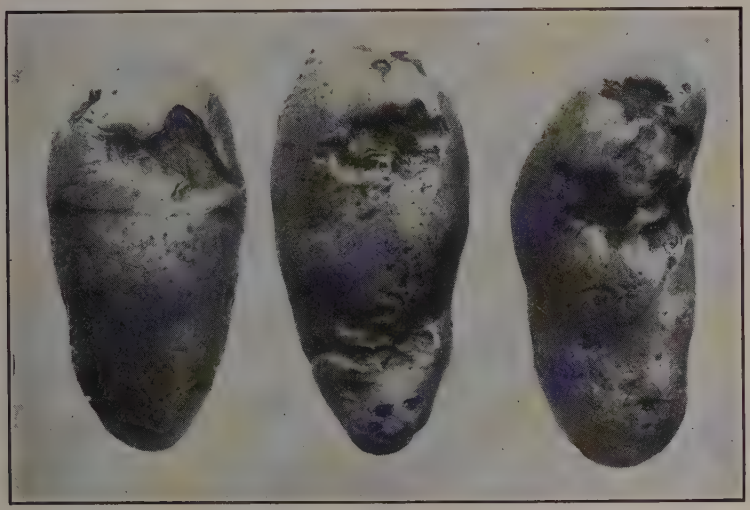


Fig. 5.—"Delaware" potato tubers showing "Macrosporium Storage Disease" due to *Macrosporium solani*. x 2/5. *Photo by author.*

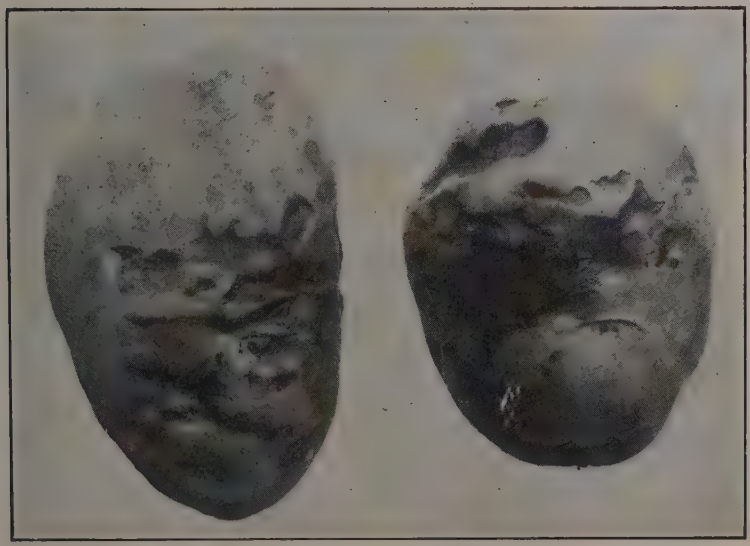


Fig. 6.—"Delaware" potato tubers showing very large lesions due to "Macrosporium Storage Disease." Such lesions develop in tubers dug immature where large areas of skin are rubbed away in the digging operations. x ½. *Photo by author.*

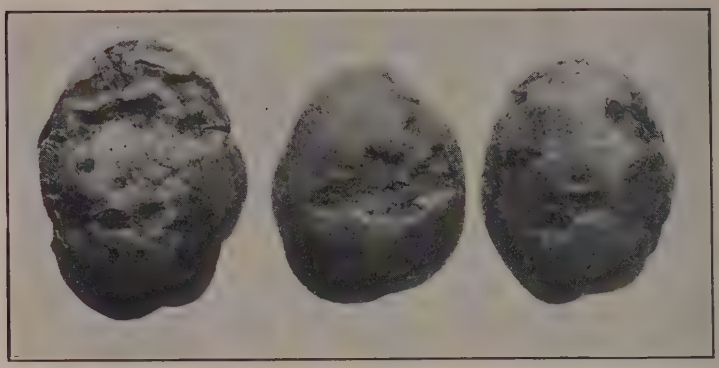


Fig. 7.—"Delaware" potato tubers showing characteristic lesions of the "Macrosporium Storage Disease." x 2/5. *Photo by author.*

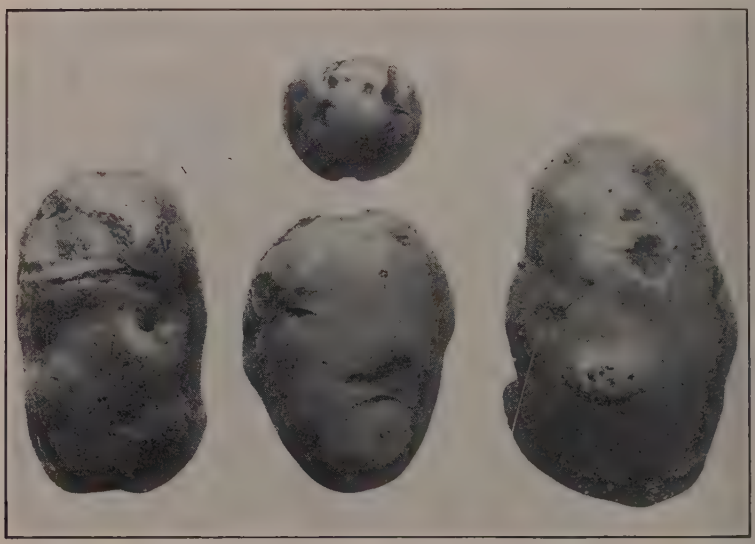


Fig. 8.—"Manistee" (top) and "Delaware" potato tubers (below), showing lesions due to attack by *Macrosporium solani*. Infection is just commencing in the tuber on the left at several places where the skin has been rubbed away. x 2/5. *Photo by author.*

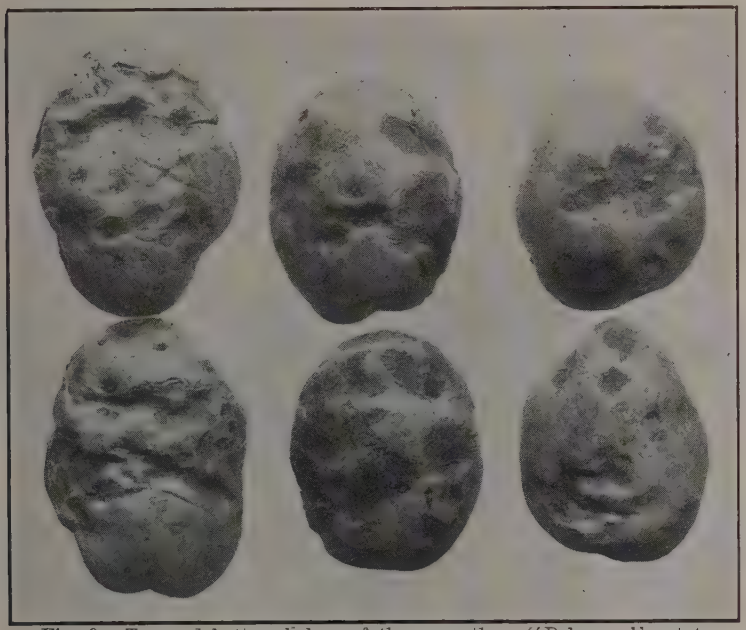


Fig. 9.—Top and bottom halves of the same three "Delaware" potato tubers, showing how serious the deterioration caused by *Macrosporium solani* may be under favourable conditions. x 2/5. *Photo by author.*

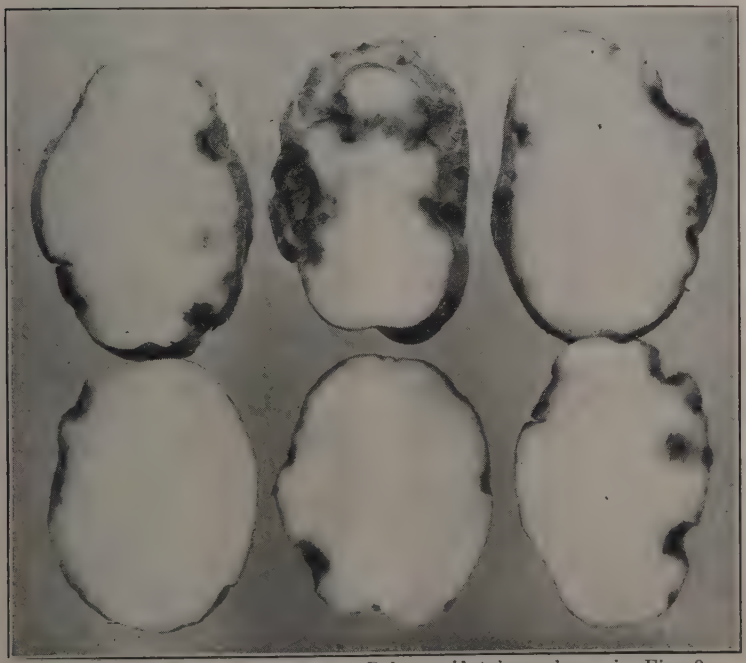


Fig. 10.—Sections of the three "Delaware" tubers shown in Fig. 9, showing the characteristic dry, dead, brown areas in the flesh beneath the surface depressions. The internal dead tissue is often, in proportion to the external dimensions of the lesions, surprisingly scanty. *Photo by author.*

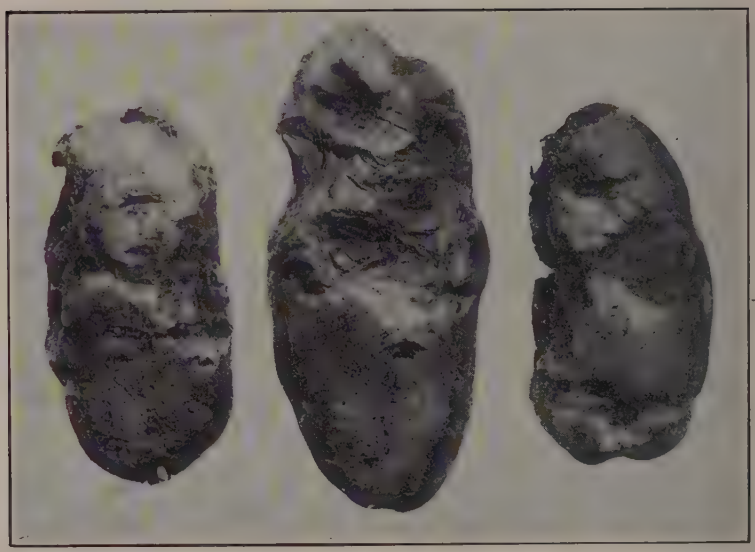


Fig. 11.—"Delaware" tubers in late stages of the "Macrosporium Storage Disease," showing secondary infection of the lesions by *Fusarium oxysporum*. In such cases the internal tissue of the tubers is soon completely destroyed. x 2/5. *Photo by author.*

PIGS AND PIG RAISING.

(*Continued.*)

LARGE BLACK.

Origin veiled in obscurity. No evidence of mixture of breeds. For generations Large Black was the only pig known in Devon, Cornwall, Suffolk, and Essex. First herd book 1899.

A Large Black Sow.

Characteristics—

Relative size.—Large; nearly equal to Large Yorkshire and Tamworth.

Adaptability.—Excellent. Very placid and contented disposition. Particularly suited to small farmer. Good foragers—eat almost anything—are not finicky in their tastes. The condition of their skin, fineness of hair and colour are the reasons for their powers of resistance to the harsh sunlight.

Maturing qualities.—Medium.

Grazing and feeding qualities.—Excellent grazers. Respond well to feed. Good foragers.

Quality of meat.—Medium. Noted for whiteness and firmness of fat. Large carcase. Big bone.

Value for crossing or "grading up."—Excellent to improve size and litters, depth of body, grazing.

Breeding qualities.—Very prolific, large litters, good mothers.

Outstanding points—

Head.—Medium length.

Ears.—Long wide, falling over face, fine in texture.

Jowl.—Medium.

Neck.—Fairly long.

Back.—Long, broad, inclined to arch.

Sides.—Very deep.

Ribs.—Well sprung.

Barrel.—Ample capacity.

Hind quarters.—Long, wide, not drooping overmuch.

Hams.—Large and well filled.

Legs.—Comparatively short, straight, well placed.

Skin.—Fine, mellow to touch.

Hair.—Somewhat sparse, fine silky.

Objections—
Head.—Narrow, dished nose.
Skin and hair.—Coarse or curly.
Disqualifications—
Ears.—Thick, coarse or erect.
Colour.—Other than whole black.

POLAND-CHINA.

Origin, Ohio, America. Foundation native pig of America crossed with the Russia and Big China, and later Berkshire prior to 1835. No out-cross since 1845. Original type much larger than present day.

A Poland-China Sow.

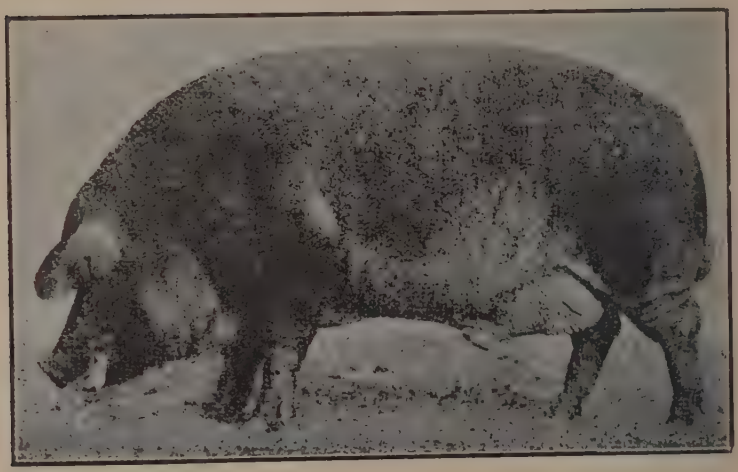
Characteristics—
Relative size.—Medium.
Adaptability.—Fairly good. Even in temperament and tractable. Quick growers.
Maturing qualities.—Most excellent. Early, probably the leading (closely resemble Berkshire); often do so too rapidly and interfere with growth.
Grazing and feeding qualities.—Require good pastures. Good doers, but require plenty of food.
Quality of meat.—Kill well. Small bone and percentage offal. Meat fine in grain and tender, but proportion of fat large.
Value of crossing for "grading up."—Cross well on large, common coarse sows deficient in compactness, requiring early maturing and improved feeding. Not suitable to cross with small sows.
Breeding qualities.—Only fair.
Principal points—
Head.—Short, wide, tapering to nose.
Ears.—Small, soft, drooping forward gracefully, not flopping.
Jowl.—Full, firm, but not over prominent.
Neck.—Wide, deep, short, arched.
Back.—Broad, straight or slightly arched, medium length.
Ribs.—Well sprung.

Barrel.—Smooth, firm, deep capacity, very symmetrical.
Rump.—Broad, rounded slope to tail.
Hams.—Very broad, full and well fleshed.
Legs.—Short, well set, square.
Skin and hair.—Fine, straight, plentiful.
Colour.—Black with white face, feet, legs, and tip tail. Few small white spots on body no objection.
Objections—
Head.—Dished, like Berkshire.
Ears.—Flopping too much.
Back.—Hollow, too long.
Legs.—Long, crooked, weak.
Colour.—Solid black or more than quarter white, sandy spots.

OTHER BREEDS OF PIGS.

A Gloucestershire Old Spot Sow.

A Hampshire Sow.



A Duroc-Jersey Boar.

A Chester White Sow.

BREEDING.

Grading-up and Cross-breeding.

To make pig-raising fully profitable it is essential that a good marketable class of pig be bred—breed to suit your own market. We have ample demonstration of the want of a definite purpose in breeding pigs in vast numbers of poor quality animals that are seen both on the farm and at the

bacon factories in Australia generally, and when one considers that the original pigs of Australia were imported (there were no wild pigs)—and naturally one would expect only good types of the various breeds to have been brought to Australia—we have to-day, in a great many cases, a type of mongrel pig that has degenerated very greatly, and it can only be attributed to haphazard mating, neglect in breeding, feeding, and handling. In most instances of poor type it is the result of the crossing breeds with no defined purpose—mixing them up hopelessly. We have the same thing existing in dairy cattle breeding, in many cases mixing the breeds with each successive generation—utter lack of any object or purpose in breeding—just drift—the nearest or cheapest bull or boar that can be got is used on the cows or sows without any regard for the suitability or weakness of the animals mated, with the result that there is mixed, unsuitable, unprofitable, poor type progeny; a gradual deterioration instead of advance and improvement.

In breeding dairy cows we have their milk and butter production to guide us—in breeding pigs we have the market requirements of shape, size, and meat qualities and economical early mating to aim at, and success, advancement, and prosperity will be only obtained by close attention to *breeding and feeding.*

The average pig raiser cannot at a moment's notice dispose of his mongrel, low-type sows and replace them with the desirable profitable kind. He cannot afford to, but he can start out on a new forward policy of improving his stock, and the first thing to do, without any doubt, is to secure a pure bred, well-shaped boar of a breed suitable to mate with the sows. The aim is to remedy the faults of the sows in their litters—to get bigger and better litters—better shapes, better market quality meat, and vigorous healthy economical growers. The boar will do this, but the boar must be pure bred and of good type, and the only guarantee of purity is registration in the Herd Book. Purity is prepotent, because there is a preponderance of one blood. The progeny of a pure bred boar mated to mongrel sows are stamped with their sire's characteristics. They are better shaped, have better constitutions, are better fleshed, and are better doers. This means higher prices per lb. and cheaper feeders.

The mongrel or cross-bred boars being used are the principal cause of the limited profits in pig raising, and are prejudicial to the industry. The low-typed mongrel boar is a calamity.

"Grading-up" means using pure males of one breed by a succession of matings, starting with mongrel females and continuing it without deviation—a concentration of one blood is obtained. The mongrel blood is bred out and a fixed type obtained. To improve on the low type mongrel pig select the best type young sows from each generation, and mate to pure boars of the breed commenced with—do not change the breed of boar—if you do you start downhill again, and often slide right to the bottom in one step. By a definite policy of "grading-up," such as has been outlined, a pig breeder builds up good type and quality, shapely, fast growing and profitable market pigs. His stock are worth looking at, and they are money makers, and the man has achieved something to be proud of—he has improved his herd.

"Grading-up" does not require capital—beyond the cost of a good male to start with. It, however, requires a decision of breed, a steadfastness of purpose, care in mating, handling, and culling, and success is assured.

The Pure Berkshire Boar is a great favourite to "Grade up."

Cross-breeding means mating pure males of one breed with pure females of another breed. It does not mean mating one cross-breed with another cross-breed, or cross-breed with mongrel, or mongrel with mongrel. In cross-breeding we obtain results that can be depended upon with a considerable degree of reliability for uniformity or similarity of type, but when the crossing is further crossed or criss-crossed the results are most irregular and unreliable. Cross-breeding is often resorted to for the purpose of meeting the market requirements as regards type of meat, size of carcase, and to increase prolificacy. For instance, we have of the different pure breeds the following tendency to weakness:—

Berkshire.—Inclined to become over-fat; smallish litters; indifferent mothers.

Tamworth.—Slow maturers; unshapely sides and hams; large percentage of bone and offal.

A Crossbred Berkshire-Middle Yorkshire.

Large Yorkshire.—Inclined to over-fat; not suitable for hot climates; large percentage of bone and offal; slow maturers.

Large Black.—Inclined to coarseness; slow maturers; large percentage of bone and offal; over-fat.

Poland-China.—Inclined to over-fat; small litters.

FOR VARIOUS MARKET REQUIREMENTS THEY RANK AS FOLLOWS:—

For Pork.—Small Yorkshire, Poland-China, Berkshire, Mid. Yorkshire.

For Bacon.—Berkshire, Mid. Yorkshire, Poland-China, Tamworth, Large Black.

Pork (for export).—Berkshire, Mid. Yorkshire, Large Black, Tamworth, Large Yorkshire.

Bacon (for export).—Berkshire, Yorkshire, Large Black, Tamworth, Poland-China.

As Rustlers (Australian conditions).—Tamworth, Large Black, Berkshire, Yorkshire, Poland-China.

As Grazers (and self-feeders).—Berkshire, Large Black, Yorkshire, Tamworth, Poland-China.

Stye feeders.—Poland-China, Yorkshire, Berkshire, Large Black, Tamworth.

For prolificacy and nursing young.—Tamworth, Large Black, Yorkshire, Berkshire, Poland-China.

Early maturing.—Berkshire, Poland-China, Yorkshire, Large Black, Tamworth.

Grading-up Boar or crossing.—Berkshire (stands out in Australia), then Mid. Yorkshire, and Tamworth.

The Ideal Porker (small to medium).—Pure Yorkshire, Berkshire, Poland-China. Cross-bred Berkshire—Yorkshire. Poland-China—Yorkshire. "Graded-up" Berkshire. Mid- Yorkshire, Poland-China.

Baconers (small to medium).—Pure Berkshire, Yorkshire, Tamworth. Crossbreds: Berkshire × Berkshire—Tamworth; Berkshire × Berkshire—Large Black; Berkshire × Yorkshire. "Graded-up" Berkshire, Yorkshire, and Tamworth.

Porkers (large).—Pure Yorkshire, Berkshire. Cross-breds: Berkshire × Mid. Yorkshire; Poland-China × Yorkshire. "Graded-up" Berkshire, Yorkshire, Poland-China, and Large Black.

Baconers (large).—Pure Berkshire, Yorkshire, Large Black, Tamworth. Cross-breds: Berkshire × Berkshire—Tamworth; Berkshire × Berkshire—Large Black; Berkshire × Yorkshire. "Graded-up" Berkshire, Yorkshire, Tamworth, and Large Black.

In placing the various pure breeds, cross-breeds, and grades an endeavour has been made to advise pig-raisers in regard to all aspects of marketing, climatic conditions, and breeding in order that they may breed a class of pig that is likely to be most suitable, the main considerations of which are quality and percentage of meat, suitability for particular purpose the pig is to be killed, blending of fat and lean, shape and size of side, ham, etc., early maturing, hardy, thrifty, prolific, and nursing. In a hot climate like ours weighty fat sides of bacon are not favoured. Retailers prefer a medium side, well streaked with lean.

The writer's experience points unquestionably in the law of averages under West Australian conditions that the pure Berkshire, highly-graded Berkshire, pure Medium Yorkshire prove the best porkers, and for baconers the Berkshire-Tamworth Comeback, viz., Berkshire crossed with Berkshire-Tamworth sow, stands pre-eminent, with pure Berkshire, highly-graded Berk-

shire in that order. In regard to the Berkshire-Tamworth Comeback it should be bred as follows:—Pure Berkshire boar mated with pure Tamworth sow (both of good type), and sows selected from this mating and bred back to Berkshire boar—the progeny to be marketed; additional brood sows to be bred Berkshire boar crossed with Tamworth sow. Thus a pig-raiser would start out and procure a pure Berkshire boar and a pure Tamworth sow or sows, and raise his own breeding sows to breed back to a Berkshire boar unrelated to the sire of the brood sows. Excellent results (as baconers) have been seen by using a Large Black sow in place of the Tamworth, or what is called a Berkshire-Large Black Comeback.

It is to be remembered that in the case of the pure Berkshire often too much fat in the bacon, smaller litters, and deficiency in nursing are obtained. In the highly-graded Berkshire much depends upon whether the original females had a percentage of Tamworth or Large Black blood, remembering always that the Tamworth and Large Black impart prolificacy, are excellent mothers, good foragers, have length and depth of sides, and in the case of the Tamworth increased percentage of lean in the rashers.

It will be readily understood that it is most difficult to dogmatise in this direction, and that the results will be varied according to the market requirements, climatic, pasturage, and forced feeding conditions, and types of boars and sows used.

PROGRESS REPORT.

Blowfly Survey of the South-West.

L. J. Newman, F.E.S.,
Economic Entomologist.

The object of this investigation is to determine the abundance, distribution and seasonal appearance of the different species of blowflies, and to demonstrate the effectiveness of luring and trapping the flies.

The trap used was the West Australian Blowfly Trap. At each of the State Experiment Farms and in the insectary grounds, Perth, a trap has been installed.

With the assistance of the farm managers the capture each month is collected and forwarded to the entomological laboratory. Here the total capture is determined, the species of flies identified and recorded, and the preponderance of any species noted.

Appended hereunder in tabulated form are the results of the progressive captures to date.

It has been observed that the lure after ten days fails to prove attractive to true blowflies, but has a very strong attraction for other species of Muscidae, which includes the common house and stable flies.

It is possible that the relatively low percentage of blowflies shown in some instances in the following table is due to this fact. It is therefore advisable to renew the lure every ten days and at the same time to empty the trap of the capture as the flies are more readily enticed up the cone, into the top chamber, if light is permitted to penetrate.

When the flies are allowed to accumulate around the cone, they cut off the light, which is essential, and thus many flies may escape capture by returning through the ingress openings.

At the conclusion of the survey, which is to occupy twelve months, detailed results, giving the numbers and percentages of each species captured each month at each station, will be published.

Month.	Perth.		Perenjori.		Merredin.		Chapman.		Wongan Hills.		Avondale.		Salmon Gums.	
	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.
April ...	29,000	27,978	30,000	26,400	20,000	5,200	1,000	900	...	...	...	...	...	...
May ..	7,200	6,513	36,000	36,000	1,760	1,026	...	...	...	...	...	...	40,000	Trace.
June ..	5,200	2,969	8,000	6,936	7,000	2,296	21	20	3,750	375	...	...	...	...
July ...	3,553	1,121	13,000	11,885	437	308	1,320	1,287	353	215	...	...	32,000	Trace.
August ..	3,285	1,620	36,000	35,748	7,000	6,223	4,500	4,383	17,000	10,013	5,000	4,305	40,000	8,150
September	33,000	14,784	62,000	51,600	22,000	16,340	15,000	10,635	38,000	9,300	16,500	15,675	...	...
October ...	43,000	17,558	60,000	52,680	33,000	19,899	12,000	7,848	30,000	8,540	11,500	10,925	70,000	1,460
Total ...	124,238	72,543	245,000	221,249	91,197	51,292	33,841	25,073	89,103	28,443	33,000	30,905	182,000	9,610

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder Smith & Co., Limited, Perth:—

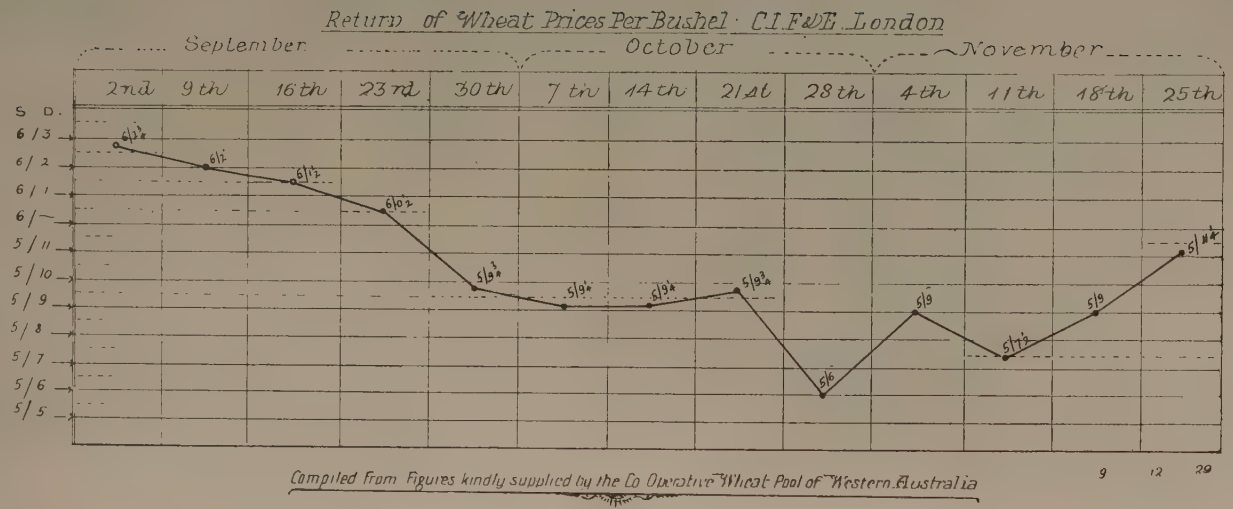
COMPARATIVE YARDINGS OF STOCK YARDED AT METROPOLITAN FAT STOCK MARKETS DURING SEPTEMBER, OCTOBER, AND NOVEMBER, 1929.

	September.				October.					November.			
	4th	11th	18th	25th	1st	8th	16th	23rd	30th	6th	13th	20th	27th
Sheep and Lambs	13289	10460	12,613	12,546	10,076	13,401	17,087	16,290	17,714	20,318	15,189	14,738	9,499
Cattle ...	702	715	802	956	519	673	470	684	636	823	690	797	719
Pigs ...	481	428	563	674	668	558	813	744	616	756	707	863	661

COMPARATIVE VALUES PER POUND OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS DURING SEPTEMBER, OCTOBER, AND NOVEMBER, 1929.

	September.				October.					November.			
	4th.	11th	18th	25th	1st	8th	16th	23rd	30th	6th	13th	20th	27th
Mutton ...	d. 7	d. 7	d. *4½, 6½	d. *4½, 6½	d. *5, 7	d. *5, 7	d. *5, 7	d. * 5, 7	d. *4½	d. * 4½	d. 4½	d. 4½	d. 5½—
Beef ...	6	6½	6	6	6½	7	8½	8	7½	6	6½	7½	8
Pork ...	10½	10½	11	11	11	11½	11½	11½	11½	11½	11½	11½	11½
Bacon ...	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9

* Shorn.


Return of Wheat Prices Per Bushel C.I.F. & E. London
September
October
November
2nd
9th
16th
23rd
30th
7th
14th
21st
28th
4th
11th
18th
25th
S D.
6/3
6/2
6/1
6/-
5/11
5/10
5/9
5/8
5/7
5/6
5/5
6/3½*
6/1½
6/1½
6/0½
5/9¾*
5/9*
5/9*
5/9¾*
5/6
5/9
5/7½
5/9
5/11½*
Compiled from Figures kindly supplied by the Co Operative Wheat Pool of Western Australia
9
12
29

MARKET REPORT.

Messrs. H. J. Wigmore & Co., Ltd., of Wellington Street, Perth, have supplied us with the following information regarding chaff available at the metropolitan chaff and grain auction sales held in Perth for the period September to November (inclusive). In all cases the prices quoted are for f.a.q. to prime wheaten chaff, packed in new bags:—

	Quantity.	Maximum.	Minimum.
	tons.	per ton.	per ton.
September	1,150	£6 0 0	£5 10 0
October	1,200	£5 15 0	£5 0 0
November	1,450	£5 10 0	£4 15 0

It will be noticed that the market was at its lowest point in November, as low as £4 15s. per ton being accepted. The cause of this was the usual temporary glut generally experienced at this time of the year, most growers of hay being anxious to cut and sell from the stook and consequently with more chaff available at that period than is required for consumption, low prices have to be accepted. At time of writing the position is brighter, the market being steady at £5, and we have no doubt that better prices will rule in the near future.

Oaten Chaff.—A fairly large quantity of prime quality oaten hay was cut along the Eastern Goldfields line this season, and farmers being anxious to sell this from the stook resulted in the market being more or less glutted. During the past few weeks prime samples have been selling as low as £4 10s. per ton. This is an unpayable price from the growers' standpoint and we believe that in a few weeks when stook cutting is completed, values will improve.

Oats.—Heavy supplies have been available during the period under review and with a poor demand, consignments have been difficult to quit at low prices, good heavy feeds selling at from 2s. 2d. to 2s. 3d. per bushel; mediums, 1s. 9d. to 2s. At time of writing consignments are not arriving so freely, and the market has improved a little, good heavy feed Guyras and Algerians being worth 2s. 5½d. to 2s. 6½d.

Wheat.—This market has fluctuated considerably, there being a firm demand at the moment for f.a.q. at around 5s. 3d. per bushel; other qualities at lower prices according to sample.

METEOROLOGICAL INFORMATION.

Stations	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	SEPTEMBER, 1929.						OCTOBER, 1929.						NOVEMBER, 1929.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	72·7	85·3	45·4	38·6	0·73	1·68	76·6	90·8	50·2	43·2	0·35	0·99	79·6	93·6	55·0	47·0	1·06	0·26
Geraldton	70·9	88·8	50·6	44·2	0·65	1·39	72·6	91·0	55·1	44·4	0·27	0·71	74·3	94·0	59·7	53·0	0·63	0·25
Walebing	69·3	82·8	40·8	35·0	0·74	2·21	74·3	91·0	46·8	41·5	1·49	1·35	79·0	95·0	52·4	44·3	1·16	0·54
Perth	67·3	82·5	48·5	43·0	2·82	3·45	71·3	85·5	52·1	41·9	1·09	2·21	73·7	85·8	57·0	52·4	1·12	0·79
Kalamunda	67·5	79·6	46·5	39·9	2·08	4·77	71·6	87·0	49·7	39·9	2·34	3·24	69·6	83·0	53·3	49·0	1·30	1·05
Bunbury	63·9	70·0	44·4	36·0	0·97	3·76	67·4	81·4	48·7	35·8	0·77	2·46	70·7	82·0	54·1	44·0	1·16	1·02
Bridgetown	66·4	78·2	38·9	31·0	1·89	3·99	72·5	89·0	42·6	33·0	1·87	3·06	76·4	87·2	49·7	39·0	2·23	1·12
Albany	63·8	81·0	48·0	39·0	3·06	4·15	64·7	83·0	51·0	43·5	2·06	3·27	68·1	79·5	54·6	48·0	6·71	1·33
Merredin State Farm	70·3	87·1	40·9	32·8	0·13	0·99	75·6	91·0	47·3	34·8	0·35	0·80	78·5	99·2	54·2	46·9	2·20	0·35
York	70·5	83·6	39·6	34·0	0·33	1·63	75·8	92·0	45·5	36·0	1·50	1·04	78·7	93·0	52·9	47·0	0·74	0·43
Narrogin State Farm	66·2	78·8	40·7	33·2	1·67	2·34	70·7	88·1	42·8	33·1	0·75	1·48	75·1	89·0	50·7	42·0	1·81	0·55
Katanning	65·3	80·0	41·9	33·3	0·86	1·98	71·2	88·0	44·3	35·4	1·28	1·60	74·3	86·7	50·9	43·7	3·55	0·62
Cape Leeuwin ...	62·2	70·5	51·4	44·8	1·80	3·48	64·4	75·0	53·1	46·0	1·46	2·95	68·0	72·5	57·5	51·2	2·29	1·22

PRODUCERS' MARKET REPORT.

The Producers' Markets, Ltd., report as follows for quarter ending 7th December, 1929:—

Good supplies continued throughout; all prime lines of all variety realised good prices. Up to November we were favoured with large consignments of tomatoes from Geraldton, all prime realising good prices. Owing to dry weather conditions this year, the tomatoes were not up to previous years in quality, large portion being small. Local tomatoes since increased in volume. Supplies are heavier than previous year, all prime lines selling to a good demand. Lemons were unsettled only towards the end, same increasing in volume, also quantity and price, selling up to 15s. three-quarter bushel. Navels and oranges in the early part were steady, owing to weather conditions being wet brought forward plenty of windfalls. About the middle of November prices began to improve, and have remained firm, navels realising up to 22s. 9d. bushel, and oranges 23s. 6d. Loquats are falling off in volume; all prime lines realised good prices throughout this season. There have only been a medium supply of Cape gooseberries forward, these realising good prices throughout. All prime strawberries sold well. There are a lot of poor quality berries coming forward. Commencing in November, cherries have been increasing in volume, all prime selling to a good demand. A good lot continue to come forward wet and over-ripe, which appears to us are packed much over-ripe and will not carry. There has been good supplies of apples forward throughout. Prime G. Smith and Yates have realised highest prices. All prime lines of other varieties realised well. During the whole period small apples were forward in volume, which had a tendency to keep all prime lines 15s. to 23s. 6d. Stone fruit coming forward heavy also plays a big part in keeping apples steady. Apricots commenced on about 13th November and have increased in volume, small fruit being heavily supplied, and towards the end sold down to 2s. 3d. A good lot forward are showing a lot of shot hole. Large and clean fruit realised good prices. Peaches are also heavily supplied, only prime lines being in demand, small fruit selling very cheap. Towards the end grapes made their appearance, realising satisfactory prices. Only a medium supply of plums forward; only ripe and coloured lines were favoured.

VEGETABLES.

Supplies of vegetables for the month have been consistently heavy. Metropolitan potatoes have shown a sharp decline in values owing to the collapse of the markets in the Eastern States. Country growers were more fortunate in securing the higher values obtained before the collapse. Pumpkin values have been steady, prime lines particularly being in good demand. Inferior sorts have been hard to quit, and value for these are never high. It would be better for growers to market these early in the season, as the demand for inferior quality pumpkin is rarely good. Swedes have been plentiful; values have been low, and stocks hard to quit at any figure at all. Cabbage has fallen off in quantity a little, but values have firmed, and good quality lines in good demand. Rhubarb heavily supplied, and values are easier with the marketing of the stone fruit crop. Peas have been plentiful, and values steady. Beans plentiful, both runner and French, and values

soon fell to glut level. White onions, particularly Globe, are in demand, and prime samples of the right size are selling well. Brown onions are also selling well, and prime dry lines are scarce. Marrow are heavily supplied now to a weak demand. Cucumbers also are heavily supplied, and values are firmer now that the tomato crop is in full swing. Bunch lines have been heavily supplied and values have been low for all lines. Lettuce of good quality has been in good demand, and values firm for these; inferior lines plentiful, and values for these low.

EGGS.

Heavy supplies came forward early in September to a reduced market, prices being 11d. at auction and 1s. 2½d. for export. During September prices advanced to 1s. 2d. at auction. The same price appertained during October, with advanced price during November to 1s. 4½d. for best quality metropolitan eggs.

POULTRY.

During September heavy supplies to a good demand, with values not quite equal to late August sales. Turkey gobblers were short in supply, and realised up to 44s. During October prices were slightly easier. November prices were on a par with October, with the exception of Turkey gobblers and cockerels, which were keenly sought after; no high value ruling. Roosters and aged light hens plentiful, and values low. At the end of November cockerels and turkey gobblers still maintained high values. Other lines hard to quit at satisfactory prices. Far too many aged and half-grown birds being marketed.

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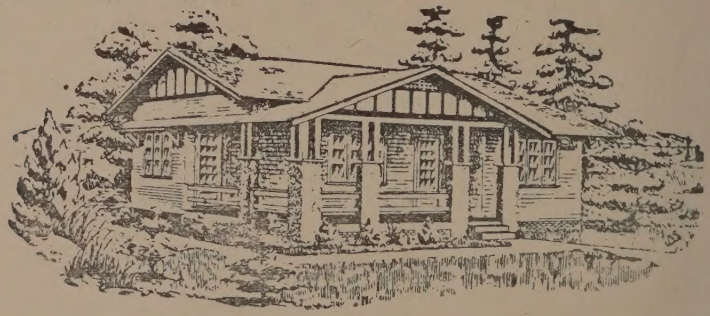

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